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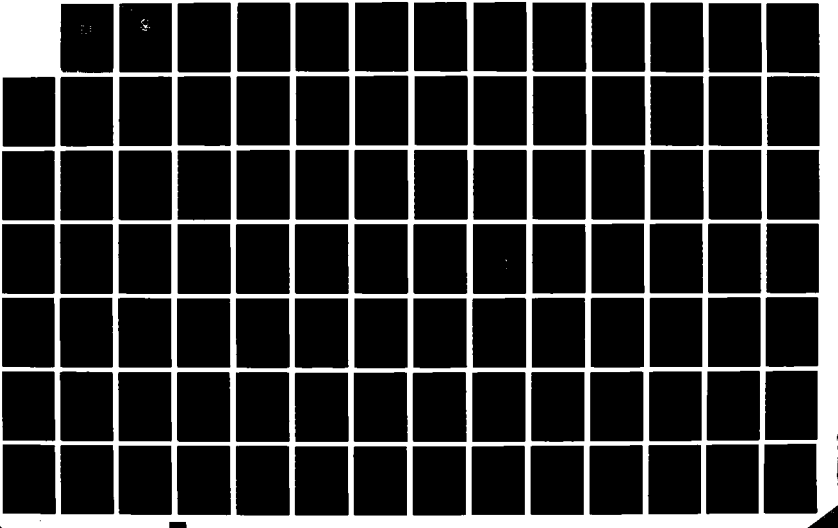

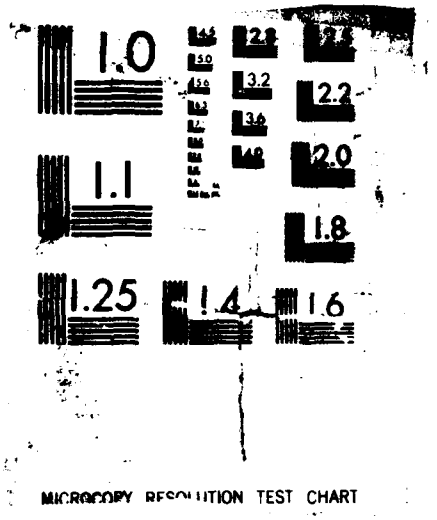

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COMPARISON OF PASCAL AND THE
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AN INVENTORY MANAGEMENT SYSTEM

by

To Chang

June 1987

Thesis Advisor: C. Thomas Wu

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Before the widespread use of Database Management Systems (DBMS), programmers have had to rely on the third generation language such as COBOL, Pascal, and PL/I to implement their application programs. These programs are usually very hard to maintain and modify unless very disciplined structured programming techniques are used. However, with the DBMS, the ease of development, maintenance, and modification of data-managing application programs can be attained. In this thesis, we compare two versions of an inventory management program, one written in Pascal and the other written in dBASE III PLUS, in terms of their modifiability and maintainability.

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Comparison of Pascal and the dBASE III PLUS language in Programming an Inventory Management System

by

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Submitted in partial fulfillment of the
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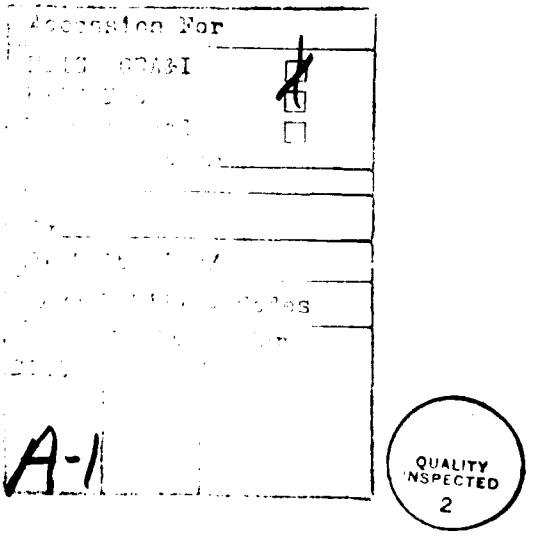
ABSTRACT

Before the widespread use of Database Management Systems (DBMS), programmers have had to rely on the third generation language such as COBOL, Pascal, and PL/I to implement their application programs. These programs are usually very hard to maintain and modify unless very disciplined structured programming techniques are used. However, with the DBMS, the ease of development, maintenance, and modification of data-managing application programs can be attained. In this thesis, we compare two versions of an inventory management program, one written in Apple Pascal™ and the other written in dBASE III PLUS™, in terms of their modifiability and maintainability.



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I. INTRODUCTION

In the early 1960's, when database processing was considered an esoteric subject, data was organized in a sequential manner. Where physical structure and logical structure are identical, and data were sent into computer as batch processing without real-time access. In this case, multiple copies of the same files are kept. At that time, the software handled the I/O operations. If the physical structure changed, application programs need to be rewritten, recompiled and retested. Data was designed and optimized for a single application, there was a high level of program/data dependence.

Late in the 1960's, both serial and random access to records was possible. The logical and physical layout of such files are distinct, but the relationship between them is simple. Now, data storage units can be changed without changing the application program. Data structure is usually designed as sequential, indexed sequential, or simple direct access. Multiple key retrieval is generally not used. Data security measures can be used but are likely to be very elementary. Still, much data redundancy exists. In this stage, software provides data access methods but not data management.

In the early 1970's, multiple logical files can be derived from the same data, and those data can be accessed in different ways by applications with different requirements. Data elements are shared between diverse applications. The absence of redundancy facilitates data integrity. Application storage organization is

independant of the application program. It can be changed to improve database performance without affecting application programs. Multiple key retrieval can be used where complex of programs. The program in this study written in the Apple Pascal data organization are used without complicating application language (see Appendix A) falls into this category.

Now, at the current stage of database processing, software provides logical as well as physical data independence. Data can evolve without incurring high maintenance costs. Utilities are provided so that a database administrator can act as controller and custodian of the data to insure that its organization is least for the users as a whole. Effective procedures are provided for controlling privacy, security and integrity of the data. With these, the database can easily provide answers to unanticipated requests. More than that, a data description language is provided for the database administrator. Also, a command language exists for the application programs, and a query language exists for the casual user. The dBASE III PLUS language (see Appendix B) falls into this category.

An amazing amount of progress has been made in the computer field since the primitive computer age of the 1950s. Personal computers, high-level languages, artificial intelligence, and many other technological advancements have been made in a period of only 35 years, and new appliactions are being discovered every day.

The idea of recording and maintaining information in an organized manner appeared many years ago, when the value of organized information was realized. The importance of this idea is stressed in the Spinoza expression : "The order and connection of ideas is the same as the order and connection of things". However,

the appearance of computers started enforcing this idea with the implementation of applications on the computer.

The use of automation and parallelism theories has also helped the designers to make retrieval of very large databases very easy, and in extremely timely manner.

The tremendous progress in the database design has resulted in lower cost, and has provided a strong motivation for working in the database develpoment field, especially on every large database.

An additionally strong motivation for working in the database field is the wide variety of database applications. These applications include manufacturing with inventory management, the servicing of industries with lists of service capabilities; economic models with production data for allocation and planning, and medical services with patient records, disease histories, problem classification, and treatment effectiveness data. Thus, database are appearing and supporting almost every science. It might be said that it is the database era in computer application.

An important consideration in the design of the database is the way of storing data, which is used for a broad variety of application and can be used to make changes to the data quickly and easily. The ability of the database to be applicable in so broad an aspect of applications is based on a common feature that makes database development valuable and general in a programming methodology. This feature is a creative form which is called "structural growth". This "structural growth" should start with a solution on a simplified version of the problem and then repeatedly expand its capabilities up to desired level.

Database systems are now available on machines that range all the way from quite small microcomputers to the largest mainframes. The facilities provided by any given system are to

some extent determined by the size and power of the underlying machine.

Following will be the detailed discussion of both the old program written in Apple Pascal which ran on Apple II PLUS, and the new program written in dBASE III PLUS which is going to run on IBM PC, followed by a study of the maintainability and modifiability of these two programs.

II. THE PROGRAMMING PRINCIPLE OF PASCAL

A. INTRODUCTION

The development of Pascal began in 1968 and resulted in a compiler written entirely in Pascal in 1970 by Professor Nicklaus Wirth of Zurich, Switzerland. The language was slightly revised in 1972 and is undergoing standardization efforts. It has become very popular as a language for teaching programming and is widely used on microcomputers. Its popularity is due to the fact that its syntax is relatively easy to learn. Also, Pascal facilitates writing **structured programs** - programs that are relatively easy to read, understand, and maintain. It is an Algol-like language, but unlike Algol's key words, Pascal's reserved words are not typed differently from identifiers.

In Algol, there are three primitive data types, and Booleans. These, in turn, were very similar to the primitive data types provided by FORTRAN. This reflects the fact that both of these languages are predominantly scientific programming languages. Numbers and logical values are the most useful objects for scientific programming. Pascal extends its applicability to commercial and systems programming by providing one additional primitive data type, CHARACTERS. Pascal is a third generation language, and a reaction to the second generation languages. Its emphasis is on simplicity and efficiency. There are two similar standards for Pascal. They are **ANSI/IEEE** (American National Standards Institute/Institute for Electrical and Electronics Engineers) Standard, and **ISO** Inter- national Standard.

Although Pascal was intended as a teaching language, many other programmers have found that it is also suitable for "real"

programming. Its strong typing simplifies debugging and helps catch latent errors in production programs; its rich set of efficient, high level data types simplifies many non-numeric programs; and its small size means that a programmer can acquire mastery of the language in a moderate amount of time.

These qualities have made Pascal an attractive vehicle for programming research. Pascal has been extended for concurrent programming, to support verification, and for operating system writing, or even a database writing (the original program in this thesis is a good example of it). Pascal has become a basis for almost all new language designs; most new languages are "Pascal-like." This includes the language Ada.

B. NAME AND CONTROL STRUCTURES

Pascal includes important additions to Algol's name, data, and control structuring mechanisms. Variable declarations are introduced by the word **var** and have the syntax:

<names> : <type>

Procedure and function declarations are quite similar to Algol's, except that the **begin** comes after the local declarations rather than before them:

```
procedure <name> ( <formals> );
  < declarations >
begin
  < statements >
end;
```

In addition to variable and procedure declarations, Pascal has constant and type bindings. Variables can declared to be the type of a range of integer. This new data type then can be used in other data types. Type declarations are introduced by the word

type and have the syntax:

< name > = < type >

Pascal has added a character data type for nonnumeric programming and a variety of data type constructors for arrays, records, sets, pointers, and so forth. Programmers can use these, in conjunction with type declarations, to design data types specifically suited to their applications. In the program HANAOKA, a lot of these techniques are used.

Pascal's control structures incorporate many of the ideas of structured programming. Of course the **if–then–else** and **for**–loop (in a very simplified form) are provided. Pascal also provides leading and trailing decision loops and a **case**–statement for handling the breakdown of a problem into many cases. The **goto** is provided in a simplified form.

C. DATA STRUCTURES

Pascal inherits the three primitive data types from Algol: reals, integers, and Booleans. These are considered to be the standard data types (or simple data types) of Pascal.

1. Real and Integer

The data types INTEGER and REAL are used to represent numeric information. People use INTEGER variables as loop counters and to represent data such as an exam score or those without decimal point. The data type REAL can be used to represent all numbers, as a matter of fact, INTEGER is a subset of REAL. On many computers though operations involving integers are faster and less storage space is needed to store integers. Also operations with integers are always precise whereas there may be some loss of accuracy when dealing with real numbers.

These differences result from the way real numbers and integers are represented internally in memory. real-numbers tend to be computer dependent; some sample integer and real formats are shown in Fig. 2-1.

Figure 2-1 Integer and Real Format

In Fig. 2-1, each integer is represented as a standard binary number. Real format is analogous to scientific notation. The storage area occupied by a real number is divided into two sections: the **mantissa** and the **exponent**. All the arithmetic operators (+,-,*,/) seen so far can be used with either integer or real operands. But the two operators, **div** and **mod**, that must be used only with type INTEGER operands. With these operators, we can write multiple-operator expressions that compute the desired results.

2. Boolean Variables, Expressions and Operators

A BOOLEAN variable or constant can be set to either of the BOOLEAN values, TRUE or FALSE. The statement

```
const
    GOOD = TRUE;
```

specifies that the BOOLEAN constant GOOD has the value TRUE. We can use the relational operators (=, <, >, etc.) with numeric data to form conditions or BOOLEAN expressions. There are three BOOLEAN operators: **and**, **or**, **not**. These operators are used with operands that are BOOLEAN expressions. BOOLEAN variables can be used as program flags to signal whether or not a special event

occurred in a program. The fact that such an event occurred is important to the future execution of the program. A BOOLEAN variable used as a program flag is initialized to one of its two possible values (TRUE or FALSE) and reset to the other as soon as the event being monitored occurs.

3. Characters Variables

Pascal provides a character data type that can be used for the storage and manipulation of the individual characters that comprise a person's name, address, etc. Character variables are declared using the data type **CHAR** in a declaration. A character value consists of a single printable character (letter, digit, punctuation mark, etc.) enclosed in apostrophes. A character value can be assigned to a character variable or associated with a constant identifier.

Relational operators can be used with characters. For example, the BOOLEAN expressions

```
SENTENCE  = BLANK
SENTENCE <> PERIOD
```

are used to determine whether two character variables have the same value or different values. Order comparisons can also be performed on character variables using the relational operators <, <=, >, >=.

4. Programmer-Defined Data Types

One of the features of Pascal that accounts for its widespread use is that it permits the declaration of new data types. In Pascal, you can define **enumerated types**, **subrange types** and **set types**.

Often programs must manipulate nonnumeric data; this is

usually character data, but it can also be more abstract. For example, a commercial data-processing program may need to be able to deal with days of the week. With **enumerated types** we can construct types by enumerating, or listing, all their possible values. For example, we can declare the types for months, days of the week, and sexes like this:

```
type
   month = (Jan,Feb,Mar,Apr,May,Jun,Jul,Aug,Sep,Oct,
            Nov,Dec);
   DayOfWeek = (Sun,Mon,Tue,Wen,Thu,Fri,Sat);
   sex = (male,female);
```

It is then possible to declare variables of these types and use them:

```
var
   today, tommorow : DayOfweek;
   ThisMonth : month;
   gender : sex;
begin
   .....
   today := Tue;
   today := tommorow;
   ThisMonth := Apr;
   gender := female;
```

Pascal also preserves security by preventing the programmer from performing meaningless operations on enumeration values. People use **abstract data type**: a set of data values and the primitive operations on those data values. For an enumerated type, the set of data values are specified in the enumeration. The operations don't have to be specified because they are the same for all enumerated types:

=, succ, pred

=, <>, <, >, <=, >=

The ordering relations (<,>, etc.) are defined according to the order specified in the declaration of the enumerated type. For example, Mon < Wen and Dec > Jan. The **succ** and **pred** functions give the succeding and preceding elements in the list. For example, succ(Mon) = Tue and pred(Mar) = Feb. These operations are also secure; for example, succ(Sat) and pred(Jan) are errors.

The benefits of enumerated types can be summaried as followed:

1. They are high level and application oriented.
2. They allow programmers to say what they mean.
3. They are efficient since they allow the compiler to economize on storage, and the operations can be performed quickly.
4. They are efficient since the compiler ensures that programmer can't do meaningless operations.

We have seen that the enumerated type improves security since the compiler can check if the programmer is doing something meaningless, such as asking for the successor of the last element in the enumeration. The Pascal **subrange type constructor** extends this checking to integers and allows tighter checking on other types. Suppose the variable DayOfMonth is used to hold meaningful values from 1-31. although this could be declared as an integer variable, our program will be more secure if we use a subrange type:

```
var  DayOfMonth : 1..31;
```

If we attempt to assign to this variable a value outside this range, we will get an error.

Subrange declarations also allow the the compiler to economize on storage utilization. Subrange types can be based on types other than integers.

```
type WeekDay = Mon..Fri;
```

If we accidently assigned Sat or Sun to a variable of type WeekDay, we would get an error. Also, Pascal permits the programmer to define subranges of any discrete type, that is, enumerated types, integers, and characters. It does not permit defining a subrange of the real numbers, which is a continuous type.

5. Set Types

Pascal provides the ability to manipulate small finite **sets** using the standard operations of set theory. The set type is almost an ideal data type. It is high level and application oriented yet very efficient.

The description of a set type has the form

set of < simple type >

where a <simple type> is an enumerated type (including **char**), a subrange type, or a name of one of these. An existing set can be modified using the set operators. Before a set can be manipulated, its initial elements must be defined using a set assignment statement. A set variable must always be initialized before it can be used with any of the set operators. The set operators union, intersection, and difference require two sets of the same type as operands. The +,*, and - are treated as set operators when their operands are sets. These operators can be used to combine two sets to form a third set. If more than one set operator is used in an expression, the normal precedence rules for the operators +,*, and - will be followed. When in doubt, it is best to use parentheses to specify the intended order of evaluation.

Sets may also be compared through the use of the relational operators =, <=, etc. Both operands of a set relational operator must have the same base type.

6. Array Types

Pascal is descendant of Algol-60, and Algol-60 generalizes FORTRAN arrays in two respects: It allows any number of dimensions and it allows lower bounds other than one. Pascal has generalized Algol's arrays in some respects and has restricted them in others.

One of the generalizations is in the allowable **index types**. They can be subscripted by many other types including characters, enumerated types, and subranges of these.

var A : **array** [1..100] **of real**;

Notice that the dimensions of the array have been specified as a subrange of the integers. Actually, any finite discrete type can be used as an index type.

Another way in which Pascal generalizes Algol arrays is in the allowable element types. Now any type can be the base type of an array type. That is, we can have arrays of integers, reals, characters, enumerated types, subranges, records, pointers, and so forth. In general, a Pascal array-type constructor has the form

array [<index type>] **of** <base type>

Where <index type> is any finite discrete type and <base type> is any type at all. Thus, Pascal arrays can be considered **finite mapping** from the index type to the base type.

Arrays can be defined as multidimensional arrays. Suppose we need a 20X100 arrays of reals M, we can define

var M : **array** [1..20] **of array** [1..100] **of real**;

As mentioned above, the base type of an array can be any type, including another array type.

7. Record Types

One of the most important data structure constructors provided by Pascal is the **record-type constructor**. This is a data structure that allows arbitrary groups of data.

```
type person = record
                name : string;
                age  : 18..100;
                rank : string;
                sex  : (male,female)
                birthdate : date;
              end;
```

Just like an array, a record has a number of components. Unlike an array, however, the components of a record can be of different types. Also the components of records can themselves be complex data types. The components of arrays are selected by subscripting. A component of a record is selected by placing a period between the name of the record and the name of the component. Selectors for records and arrays can be combined as needed to access a particular component. But why have both arrays and records since they are both methods of grouping data together. They differ in two important respects. Arrays are **homogeneous**, that is, all of the components of an array are the same type. Records are **heterogeneous**, that is, their components do not have to be the same type. In this sense records are more general than arrays.

Since arithmetic and logical operations must be performed on individual memory cells, record variables cannot be used as the operands of arithmetic and relational operators. These opeartors must be used with individual fields of a record.

The other difference between arrays and records is in their manner of selecting components. We can select specific array

elements with expressions like A[1], A[2] just as we can select specific record components with expressions like R.mon, R.day. The difference is that we can compute the selector to be used with arrays; that is we can write A[E] where E is an expression whose value will be known at run-time. This is an important feature since it allows writing a loop that process all the elements of an array. This can't be done with records.

8. Pointer Types

Pointer types are dynamic data structure of Pascal. Dynamic data structures are data structures that "grow" as a program executes. A dynamic data structure is a collection of elements (called **nodes**) that are normally records. Unlike an array that always contains storage space for a fixed number of elements, a dynamic data structure expands and contracts during program execution based on the data storage requirements of the program.

Dynamic data structures are used for storage of real world data that is constantly changing. An example would be an airline passenger list.

Dynamic data structures are extremely flexible. It is relatively easy to add new information by creating a new node and inserting it between two existing nodes. It is also relatively easy to modify dynamic data structures by removing or deleting an existing node. This is more convenient than modifying an array of records, where each record is in a fixed position relative to the others as determined by its subscript. Here is an example using this feature:

```
var  p : pointer;
     x : integer;
begin
     new(p);
```

```
        .....
        p^ := 5;
        .....
        x := x + p;
        .....
end;
```

This program allocates a memory location and puts its address in P, stores 5 in the memory location whose address is in P, and then add the contents of this location to x.

Since we don't know beforehand the order or number of **nodes** in a dynamic data structure, we cannot allocate storage from a dynamic data structure in the conventional way (using a variable declaration statement). Instead, we must allocate storage for each individual node as needed and join this node to the rest of the structure. The **new** statement is used to allocate storage for a new node.

Also we must have some way of referencing each new node that is allocated in order to store data in it. Pascal provides a special type of variable, called a **pointer variable** (or **pointer**), for this purpose.

There are four kinds of dynamic data structures use pointers in Pascal. They are : **linked lists, stacks, queues,** and **trees**. A **linked list** or simply **list** is a sequence of nodes in which each node is linked or connected to the node following it. Each node in the list has two fields : the first field contains data and the second field is a pointer to the next list element.

A stack can be thought of as a linked list in which each new node is inserted at the head of the list and each deletion removes the current head of the list. Inserting a node is a **push** operation and deleting a node is **popping** the stack.

A queue is a linked list used to model things such as a line of customers waiting at a checkout counter or a stream of jobs

waiting to be printed by a line printer. In a queue, all insertions are done at one end (the rear of the queue) and all deletions are made from the other end (the front of the queue).

So far we have involved list elements or nodes with a single pointer field. It is possible to have lists of elements with more than one link. We call it a multiply-linked list.

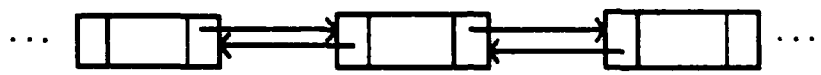


Figure 2-2 A Sample of Multiply-linked List

A special kind of multiply-linked list that has wide applicability in computer science is a data structure called a **binary tree**. (See Figure 2-3)

The details of binary tree and traverse or search of a binary tree are subjects of Data Structure, to go further into them please reference Data Structure text books.

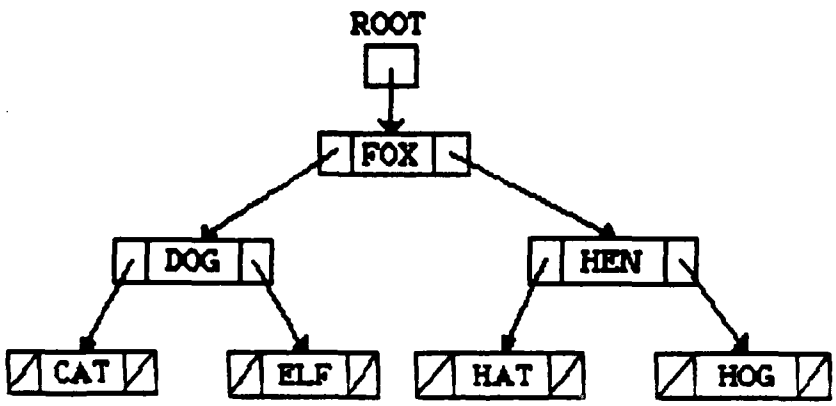


Figure 2-3 A Sample Tree

D. SUMMARY

Pascal's primary goal was to be a good language for teaching

programming. This led to subsidiary goals for reliability, simplicity, and efficiency. Pascal has been very successful in these areas.

Pascal is a particular suitable language with which to learn programming. Most modern programming concepts are available in Pascal. In sharp contrast to BASIC, things become much more complex as programs grow in size. Pascal programs, by contrast, expand gracefully. The concepts we learn with Pascal are applicable in almost any programming environment.

Much of the criticism Pascal has received results from trying to use it for purposes for which it was not designed. For example, Pascal has been criticized for its lack of a separate compilation facility, even though such a facility is not especially important in teaching programming (the language's intended application). Indeed, it is to Pascal's credit that it has been so successfully applied in so many areas for which it was not intended.

III. THE PROGRAMMING PRINCIPLE OF dBASE III PLUS

A. AN OVERVIEW OF dBASE III PLUS

A database is a central repository of related information. To paraphrase this, a database is a physical grouping of a collection of individual, but related, bits and pieces of information. The difficulty in building an effective database system is not in the mechanics of construction, but in the intelligent design and planned use of the database.

As an example, if one wants to maintain information about each and every individual employed in an organization, it is necessary to create a base of data about all the employees. This base of data could contain, for example, information about each employer's employee-number, name, salary, year of hire, and date of last promotion. This base will subsequently provide immediate access to the type of information sought. Database can and are being maintained for every subject from astronomy to zoology. Computers, because of their speed and accuracy, are the information processor, the physical means, of creating and subsequently accessing these databases.

dBASEIII PLUS is defined as a relational database manager, that is, this software helps create and maintain a relational database. A relational database is one in which the data is arranged in the form of a matrix, with the rows of the matrix forming each individual record in the database, and the columns of the matrix forming the individual fields of information. Using such a database, one can establish a relationship between two or more databases, by using a common key field of information.

B. THE dBASE III PLUS SYSTEM

So where does dBASE III PLUS fit in with all of the previous concepts and definitions?

dBASE III PLUS is the name of a software package marketed by Ashton Tate, Inc., of Culvery City, California; it is a very powerful tool for the development of microcomputer business applications. dBASEIII PLUS is a data manager. It is a piece of software that lets the user have full freedom in the conceptualization and creation of database for all types of business applications. Since business depends on timely information dissemination, the value of a powerful, programmable utility for database generation, maintenance, and query cannot be overstated. dBASE III PLUS is defined as a relational database manager, that is, this software helps create and maintain a relational database. dBASE III PLUS can be executed on a variety of microcomputers, under any one of the popular operating systems.

C. DATA TYPES OF dBASE III PLUS

Data is defined as something known or assumed; facts from which a conclusion can be inferred. Data usually represents some aspect of the physical world around us, such as a list of names and addresses, the temperarure of the room, today's date and time, or a bank statement.

A data type is a high level representation of data as seen by the user which has a corresponding binary form understood by the computer. Data types allow people to write programs using data representations with which they are comfortable. The high level representation is maintained internally as a binary format processed by the computer.

Each language provides a limited number of elementary data

types. Complex data structures can be constructed from the elementary types. dBASE III PLUS provides : **Character**, **Numeric**, **Logical**, **Date**, and **Memo**. Using these data types, complex data structures useful in representing a multitude of real world situations can be constructed.

1. Character Data Type

A field defined as a **character field** accepts any character of data entered. Character data is used to represent letters of the alphabet, numbers, and special characters. In dBASE III PLUS, the character type is made up of the set of all ASCII characters. A **character string**, often just called a **string**, is any sequence of ASCII symbols. When a number is represented as a character type, it must first be converted to numeric data before calculations can be performed with it. It is often convenient to use the character data type for numbers such as telephone numbers, addresses, and inventory stock numbers which will not be used in calculations. Some of the more common operations performed on strings are:

Concatenating strings (linking them together)

Splitting up strings into "substrings"

Testing strings for equality

Finding substrings (string patterns)

The character variable contains textlike information:"David Smith","1234 Fifth Street","Computer Science Department". Any information between the quote signs will be taken as a character string. The maximum length of a string is 254 characters. The minimum length of a string is 0.

Because dBASE III PLUS is a business oriented language, it deals much more in text manipulation than computer languages such as BASIC and Pascal.

2. Numeric Data Type

A field defined as a **numeric field** will only accept the digits 0 through 9, the decimal point, and the negative sign(-) as data. (Trying to force character data into a numeric field will lock up the keyboard.) Numeric data is used to represent integers or decimal quantities that will undergo computations. dBASE III PlUS allows a wide range of numbers and has adequate precision for most business and scientific applications. It maintains an internal precision of fifteen or sixteen digits, depending on the size of the number. This allows dBASE III PLUS to be accurate on calculations with fairly large numbers without round off error. Internally dBASE III PLUS represents numbers with the IEEE long real (64-bit) binary floating point representation. A binary floating point representation is the computer's equivalent to scientific notation. Each number contains three parts: the **sign,** either + or -, the **significand** which represents the significant digits of the number, and the **exponent** which multiplies the significand by the appropriate power to yield the correct binary point position in the final result.

3. Logical Data Type

A logical data field is one which is of a predefined length, 1 character, and will accept as input either the letters T or Y (for TRUE/YES) or the letters F or N (for FALSE/NO).The actual data is stored exactly as entered, but will be displayed on the screen or printer as .T. or .F. only. If no data is entered, the default is .F.

Logical data fields are used to represent types of data when there are only two choices for any element, such as male/female, positive/negative, yes/no, dead/alive. dBASE III PLUS can perform

conditional tests which depend on the value of a logical field.

4. Date Data Type

A date data field is also of a predefined length, eight characters, and dBASE III PLUS presumes that you will be subsequently entering a date of the format MM/DD/YY. At the time of actual data entry into this field, dBASE III PLUS automatically checks for the accuracy of the data entered. For example, an entry of 12/35/85 would invoke a beep and an error message. The built-in edit even checks for a leap-year! Date fields are very useful in that they reduce the amount of programming effort needed for routines computing time lapse, since you can add numbers to or subtract numbers from, date fields, or you can add or subtract two date fields directly.

5. Memo Data Type

A memo data field is also of a predefined length, 10 characters in the file itself, and automatically contains the word **memo** for data. Through the use of this field, you can maintain memos for individual records. Each memo could be up to 4000 characters long if the built-in dBASE III PLUS word processor is used, or can be any length if it is set up with a commercial word processor. dBASE III PLUS makes use of an external file in which it stores the contents of the individual memos, and hence the memo can have the capacities mentioned above. This external file will have the same primary name as the dBASE III PLUS file, but will have the .DBT extension for the secondary name. dBASE III PLUS maintains this file in an internally usable form.

D. DATA STRUCTURES OF dBASE III PLUS

dBASE III PLUS contains powerful high level commands which allow people to create and manipulate sophisticated data structures easily. There are several common models used to represent data structures. dBASE III PLUS uses the relational model: the data is represented in flat (two-dimensional) tables composed of rows and columns. In relational databases, a two-dimensional table is known as a "relation", and operations on these tables can be described with mathematical precision. However, the relational model is very powerful and all other common data models can be represented using two-dimensional (relational) tables.

The CREATE command is used to create a data file structure matching the body of data that it is intended to represent. This structure can store data as individual records and the data can then be easily accessed and manipulated.

1. The Data File Structure

The dBASE III PLUS data file can be seen as a two-dimensional table containing the following properties:

a. All items in a column are of the same data type; that is, the data file is column-homogenous. A column in dBASE III PLUS is a field.

b. Each column (or field) must have a distinct fieldname. No duplicate fieldnames are allowed.

c. Each row is a record and is assigned a number. The record number assigned is relative to the record's position in the data file.

A conceptual view of a dBASE III PLUS data file is:

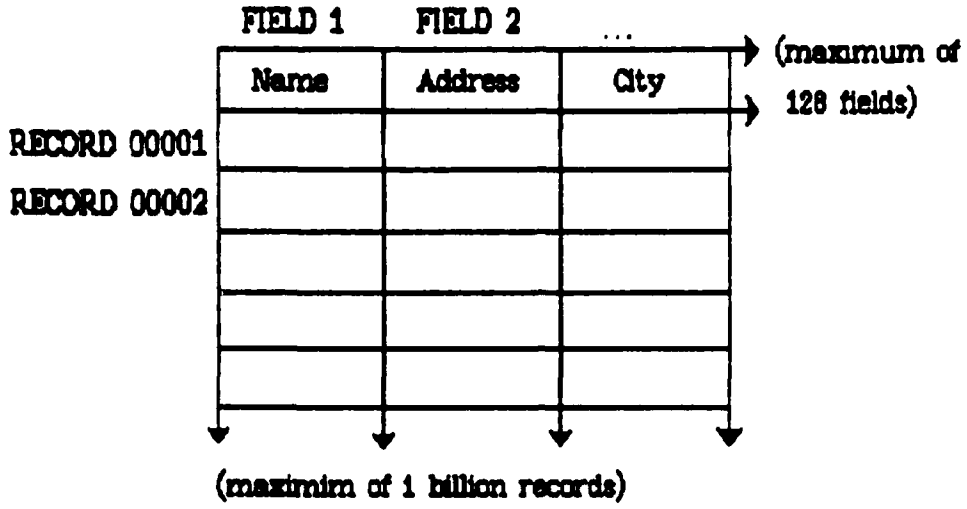


Figure 5-1

The limitations on dBASE III PLUS data files are:

File limits (maximum sizes)

Number of records/file	1 billion
Record size (bytes)	4000 bytes in .DBF file
Number of fields/record	128

Field limits

Character fields	254 bytes
Logical fields	1 byte
Numerical fields	19 bytes
Date fields	8 bytes
Memo fields	10 bytes in .DBF file

DBF file size limit only by operating system, hardware or word processor used.

2. Indexing

One of the most important features of any database system is the ability to find a specific data item from among many item

quickly. Search by index is the best way to shorten long sequential search times to only a couple of seconds.

When the INDEX ON <key> command is issued in dBASE III PLUS, a seperate index file is creates based on the key expression specified in the command line. The followings are examples of creating indexed files:

. USE Customer (Select data file)

. INDEX ON Names TO Customer (Generate index)

This index allows rapid searches of the **Customer** database by **Name** . Any record can be found in two seconds or less with the FIND or SEEK command.

E. PROGRAMMING IN dBASE III PLUS

In dBASE III PLUS, a program is actually a set of commands in sequence. To create a program, at dot-prompt, just type in:

.CREATE COMMAND pgm <CR>

This command informs dBASE III PLUS of your intention to create a **command file** (program) called pgm.PRG. The screen is then erased; the dBASE III PLUS word processor takes over; there is no dot-prompt; and whatever you key in will remain on the screen, until you either SAVE it(Ctrl-W), or DELETE it(Ctrl-Q).

To invoke the execution of a program, simply request dBASE III PLUS to:

.DO PGM <CR>

To make changes to an existing program, use the following command:

.MODIFY COMM pgm <CR>

1. Parameter Passing

The main value of parameter passing occurs when a low

command file can be called from many different programs in many situations and must be free of the naming convention used in the calling program.

There are two kinds of variables, PUBLIC(global) and PRIVATE(local). A PUBLIC variable can only be released by the programmer while a PRIVATE variable is released by dBASE III PLUS when the program returns from the command file in which the variable was created.

All variables created in a command file are PRIVATE unless specifically declared PUBLIC. All variables created in higher level command file are available to the lower level command files unless there is a clash. If a variable is declared PRIVATE in a command file and there exists another variable from a higher level with the same name, then dBASE III PLUS has to decide which variable is to be referenced and which is to be hidden. Until the PRIVATE variable is released, dBASE III PLUS hides the higher level variable and all references of the variable name refer to the lower level variable.

The variable status, PUBLIC or PRIVATE, can be directly specified:

```
PUBLIC name,city
PRIVATE salary
```

Any variable can be released with the RELEASE command:

```
RELEASE name,city
```

dBASE III PLUS automatically releases a PRIVATE variable when the user leaves a command file with RETURN, CANCEL, or QUIT. Usually variables are passed from one command file to another without specific instructions. With parameter passing, the high level command file does not have to follow the same naming convention that the low level command file uses.

PUBLIC variables should be used sparingly. Generally variables should not be made PUBLIC without some specific reason. While debugging, the most important variables should be PUBLIC so that they can be inspected if the program crashes and control returns to the dot prompt (thereby releasing all the private variables).

2. Control Tranfers From One Program To Another

Just as you invoke the execution of a program by asking dBASE III PLUS to DO <program name>, you can invoke the execution of another program from within the first one in the same way. The **calling** program, at some logical point in its execution, transfers control to the **called** program. At the end of the execution of the **called** program, control is automatically transferred to the instruction after the DO instruction that passedcontrol to the **called** program.

This concept of transferring control to subprograms and then receiving control back at the main program is very important to the programmer, since it permits the breakdown of a large complicated system into subset of logically connected, more manageable subprograms. This makes the system much more comprehensible not only to other programmers but also to the creator of the system.

F. HOW DOES dBASE III PLUS IMPLEMENT THE RELATIONAL MODEL

In dBASE III PLUS, there is a very powerful command:

SET RELATION TO

The SET RELATION creates a link between two data files. Its power stems from the fact that dBASE III PLUS will automatically look up related information from another file. This means that

FORM commands, will perform a search of another database.

As an example, suppose sales information is kept in one file and time of shipment information in a second file. SET RELATION will allow the user to produce reports on the transactions in which dBASE III PLUS looks up the sales information at each transaction. For example, in S_INQUERY.PRG:

```
SELECT 1
USE b:s_contra INDEX b:s_conind
SELECT 2
USE b:tmofship INDEX b:tmshipdx
```

then in SALELIST.PRG:

```
SET RELATION TO snumber INTO tmofship
```

this will create relationship between **s_contra** and **tmofship** with **snumber** as the common key.

SET RELATION is equivalent to a user who always performs a SEEK command at each record but it is faster than writing the individual commands and it enables many dBASE III PLUS command to utilize the second file. This gives multi-file capabilities to the nonprogrammer.

G. I/O PROCESSING OF dBASE III PLUS

The I/O processing of dBASE III PLUS is more concerning about the communication between the programmer and operator. This communication can be broken down into two categories:

1. Output:The programmer talks to the operator.
2. Input:The operator talkks to the programmer.

As mentioned above, dBASE III PLUS was designed for microcomputers. Most current I/O devices used on microcomputers are CRTs(or screen). Therefore, dBASE III PLUS contains very powerful screen handling capabilities discussed below.

powerful screen handling capabilities discussed below.

1. Output

In dBASE III PLUS, output screen handling refers to the process by which the programmer talks to the operator. The output commands used to support screen handling can be categorized according to the mode in which they work:

a. FORMATTED MODE

@ <coordinate> SAY

This command places its output at the screen location specified by the programmer, thus formatting the screen.

In addition, it has options which allow the programmer to modify the display of its data, thus formatting its output.

b. UNFORMATTED MODE

General:

?

??

Specialized:

DIR

DIRECTORY

DISPLAY

LABEL

TYPE

These commands are dependent upon the current cursor position and begin their output at that location. The most frequently used commands in communicating with the operator in dBASE III PLUS programming applications is the @ . SAY command because of the degree of control it offers. The ? command is

when a screen scrolling effect is desired.

TEXT ... ENDTEXT is a structured output command, rather than a structured programming command because it has no effect at all on program flow. It is simply a convenient way of outputting large amounts of unformatted text. The literal text must be contained within the TEXT ... ENDTEXT structure, and therefore is a constant in the command file.

c. FORMATTED SCREEN

The <coordinates> specified in the @ ... SAY command control where the output will appear on the screen. The syntax and range for computers with 24X80 screens is:

@ <coordinates> SAY <expression>

<coordinates> = <row>,<column>

<row> = numeric expression, range 0-23 (line)

<column> = numeric expression, range 0-79

Note that minus numbers cannot be used with this relative addressing operator.

d. FORMATTED OUTPUT

In addition to formatting the screen, we can also format the individual picture of each data item when we display it. The @...SAY command offers the programmers a variety of options for displaying data in a format different than the format in which it exists. For example, a numeric field cannot contain commas, but it can be displayed with commas when output with @...SAY command. The syntax and formatting options are:

@ <coordinates> SAY <expression> <format option>

<format option> = PICTURE '<picture template>'

| FUNCTION '{<function>}'

| FUNCTION '{<function>}'
| USING '{<using symbol>}'

2. Input

Input screen handling refers to the process by which the operator talks to the programmer. Output screen handling is the reverse of this. Operator input must be carefully handled. This is the time to trap all the possible errors so that the data in the database is always known to be accurate and good. The input commands used in dBASE III PLUS can be categorized according to the mode in which they work.

a. FULL-SCREEN MODE

@...GET

This command places a variable (field or memory variable) at the screen location specified by the programmer. In addition, it has options which allow the programmer to restrict the operator's input.

READ [NOUPDATE]

This command places the cursor in variables which have been placed on the screen with @...GET. This enables the operators to enter or edit data in the varaible.

b. COMMAND-LINE MODE

Memvar:

ACCEPT (character type)
INPUT (date, logical, and numeric types)
WAIT (character type, one character only)

Of course, the most frequently used commands for receiving communications from the operator is the @...GET/READ

often used to simply pause the program execution until the operator hits any key; the keystroke itself is usuall disregarded.

ACCEPT and INPUT are usually used for quick utility type applications where a high degree of error trapping is not required, or when it is desirable to give the operator lots of flexibility, such as in programmer's utilities. ACCEPT will only accept a character type literal while INPUT will accept an expression of any data type.

Screen placement and appearance of @...GET are the same as for @...SAY, which are mentioned above. There is one combination form, the @...SAY...GET which places the GET <variable> on the screen immediately following the SAY <prompt>.

```
@ 5, 0 SAY 'Your name:'
@ 5,14 GET memvar

@ 5, 0 SAY 'Your name:' GET memvar
```

These both produce the same results. The first form makes writing some screen easier. The second form runs faster.

c. FORMATTED INPUT

The @...GET command offers the programmer a variety of options for limiting the data that the operator can enter. For example, a character type variable can be limited to accepting only numbers from the keyboard. The syntax and formatting options are:

```
@ <coordinates> GET <variable name> <format option>
 <variable name> = A currently active memvar
                 | A field in the currently selected
                   database file
<format option> = PICTURE '<picture template>'
                 | FUNCTION '{<function>}'
```

| RANGE<n1>,<n2>

d. FORMAT FILE

Format files are like command files except that they contain only @...SAY and @...GET commands and comments. Format files allow the formatting of the screen during the full-screen interactive database commands APPEND, CHANGE, EDIT, and INSERT. An open format file also affects the execution of the READ command by clearing the entire screen, resetting the GET counter, and redisplaying its SAYs and GETs. DBASE III PLUS can have one format file for each of its ten work areas if this will not exceed the limit of thirteen simultaneously open files of all kinds. It also closes any open format file in the currently selected work area when a new database file is opened or any current one closed.
This command open a format file:

SET FORMAT TO <format filename>

These commands close all open format file:

CLEAR ALL

CLOSE DATABASES

These commands close only the open format file in the currently selected work area:

CLOSE FORMAT

SET FORMAT TO

USE

H. SUMMARY

In dBASE III PLUS, there are no ARRAYs, RECORDs, SETs, FUNCTIONs, ENUMERATED TYPEs nor LINKED LISTs. These were considered to be necessary for structured programming, but quite an overhead to a database system. dBASE III PLUS uses nothing

but two-dimensional tables to implement its data structures and file organizations. dBASE III PLUS consists of a set of commands each with a "syntax." Each command is extremely flexible and can perform an infinite number of variations on a particular task. It's invaluable flexibility requires more learning effort on the part of the user.

The control structures such as SEQUENCE, BRANCH, REPETITION and those algorithms which are used in most programming languages are available in dBASE III PLUS too. But dBASE III PLUS does not support recursion.

In general, dBASE III PLUS is a versatile database manager. It is designed to handle the many business applications in which the user needs to manage large amounts of repetitive information. It can function as a simple file manager. It can handle the complex issues in relating files to one another, and it can be used as a complete language like Pascal or BASIC.

IV. STUDY AND ANALYSIS OF ORIGINAL PROGRAM

A. BACKGROUND

The original program - written in Pascal, is a typical inventory management system software, written for Import/Export Company, which purchases feed stuffs such as hays, grass, etc., from farmers in California. Those feed stuffs are compressed and packed into 9X40 foot containers and shipped to foreign countries. This program was written in order to keep track of **the sales** and **the purchase.** For instance, how many tons of the grass have been purchased? How many of them have been shipped? At what price, and what time? How many tons left need to be shipped to complete a contract? The analysis of the algorithm and data structures used in this program are discussed in detail in the following sections.

B. THE ENTITY-RELATIONAL DIAGRAM

Sales and Purchases are an independent process within Hanaoka, as can be seen on the next page (Figure 4-1). The E-R diagram of Hanaoka was divided into two sub-diagrams. The upper part is for Purchases and the lower part is for Sales. There are some identical components in these two sub-diagrams.

In Sales, each sale record contains one customer and several time-of-shippings records. The sale record is used to update the sale contract according to the contract number. The sale contract uses the invoice number (input from screen) concatenated with the contract number as a new invoice number to update the sales shipment record. Data is passed from the sales record. Also the sales record can be used to check the hash file for the duplicate

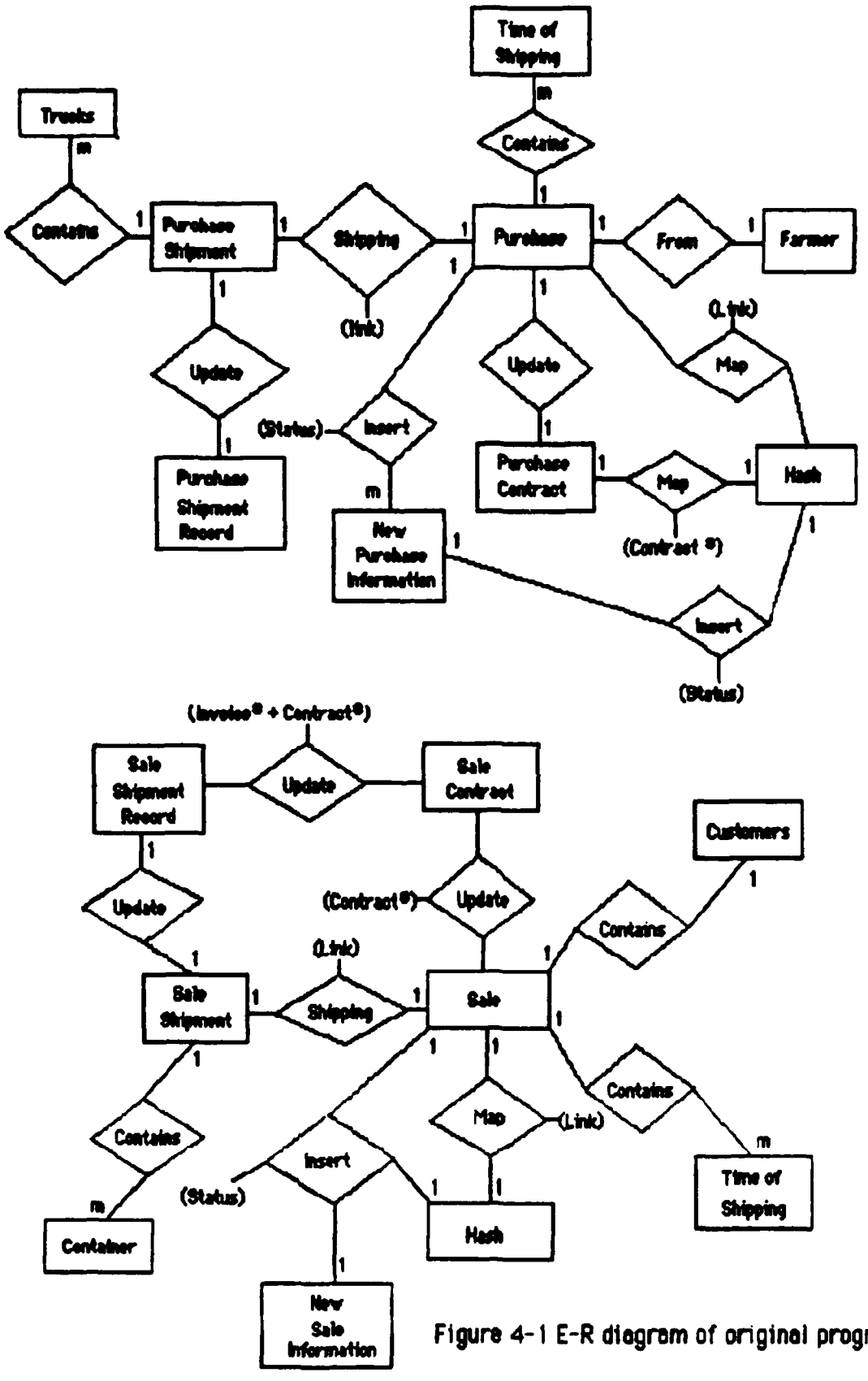


Figure 4-1 E-R diagram of original program

key. If there is no duplicate key then this sales record can be inserted into an empty slot of the hash file according to the status (empty or occupied) of that slot. Each sales shipment can be updated by the sales shipment record and each sales shipment contains several containers

In Purchase, each purchase record corresponds to each farmer. Each purchase record can contain several time-of-shipping records. New purchase information can be stored into the hash file and purchase file by checking the slot's status (empty or occupied). One purchase needs one purchase shipment record which can contain several trucks records, and can be used to update purchase shipment records.

C. PROGRAM STRUCTURES

1. Sales

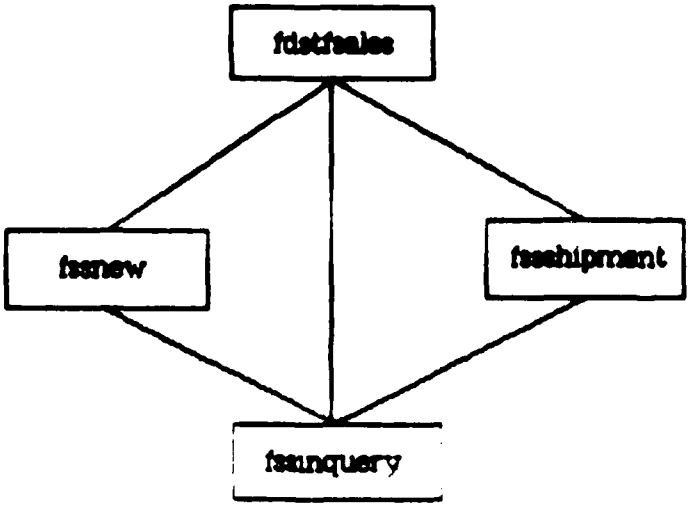


Figure 4-2 Structured diagram of Sales

The followings is the program's outline for Sales.

(For details, please reference APPENDIX A)

```
====================== SALES ======================

**********************************************************************
*                        MAIN PROGRAM                                *
**********************************************************************

SEGMENT PROCEDURE fssinquery;
{ to prompt the query concerning the feed stuff sales files }
BEGIN
END;

SEGMENT PROCEDURE fssnew;
{ to input new sales contract into the files }
BEGIN
END;

SEGMENT PROCEDURE fssshipment;
{ to input shipment information for the existing contract }
BEGIN
END;

PROCEDURE fdstfsales;
{ procedure to handle all operations concerning feed stuff sales }
BEGIN
END;

**********************************************************************
*                             FSSNEW                                 *
**********************************************************************

SEGMENT PROCEDURE fssnew;

  PROCEDURE tosconvert;
  { converts timeofship array input}
  BEGIN
  END;

  PROCEDURE getfssinfo;
  { input all pertinent info for new sales contract }

    FUNCTION proceed : boolean;
    { returns true if the input line is not empty, so not to allow
     null input }
    BEGIN
    END;

    PROCEDURE tosinfo;
    { handles one input array timeofship, different proc since the
     input format differs from other input,i,e., makes procedure
     READNEXTINPUT too long }
    BEGIN
    END;
```

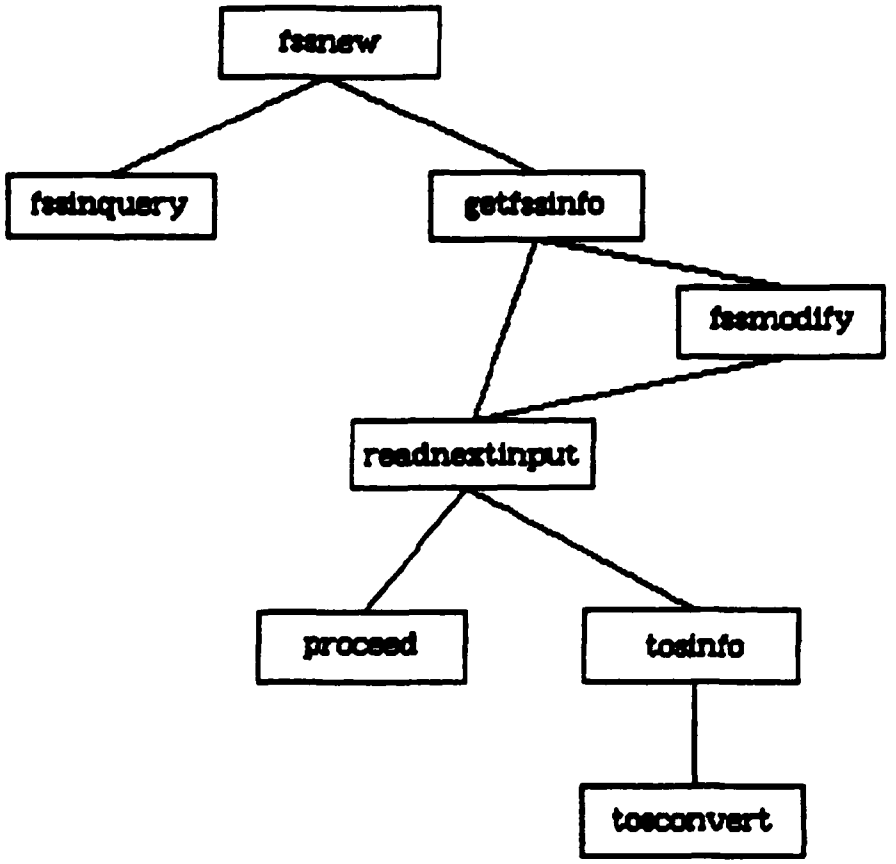


Figure 4-3 Structure diagram of FSSNEW

```
    PROCEDURE readnextinput;
    { handle one input at a time, var lineno determines which
    input }
    BEGIN
    END;

    PROCEDURE fssmodify;
    { re-reads any specified input once more }
    BEGIN
    END;

  BEGIN
  END;

BEGIN
END.
```

```
*****************************************************************************
*                              FSSSHIPMENT                                  *
*****************************************************************************
```

```
SEGMENT PROCEDURE fssshipment;

  PROCEDURE contconvert;
  { converts container array input from string to approriate data
   type }
  BEGIN
  END;

  PROCEDURE computepart;
  { does all necessary conversion (lbs->shorttons) and computation
  }
  BEGIN
  END;

  PROCEDURE getshipinfo;
  { get all pertinent info for a shipment}

    FUNCTION sproceed : boolean;
    { same as FUNC proceed }
    BEGIN
    END;
```

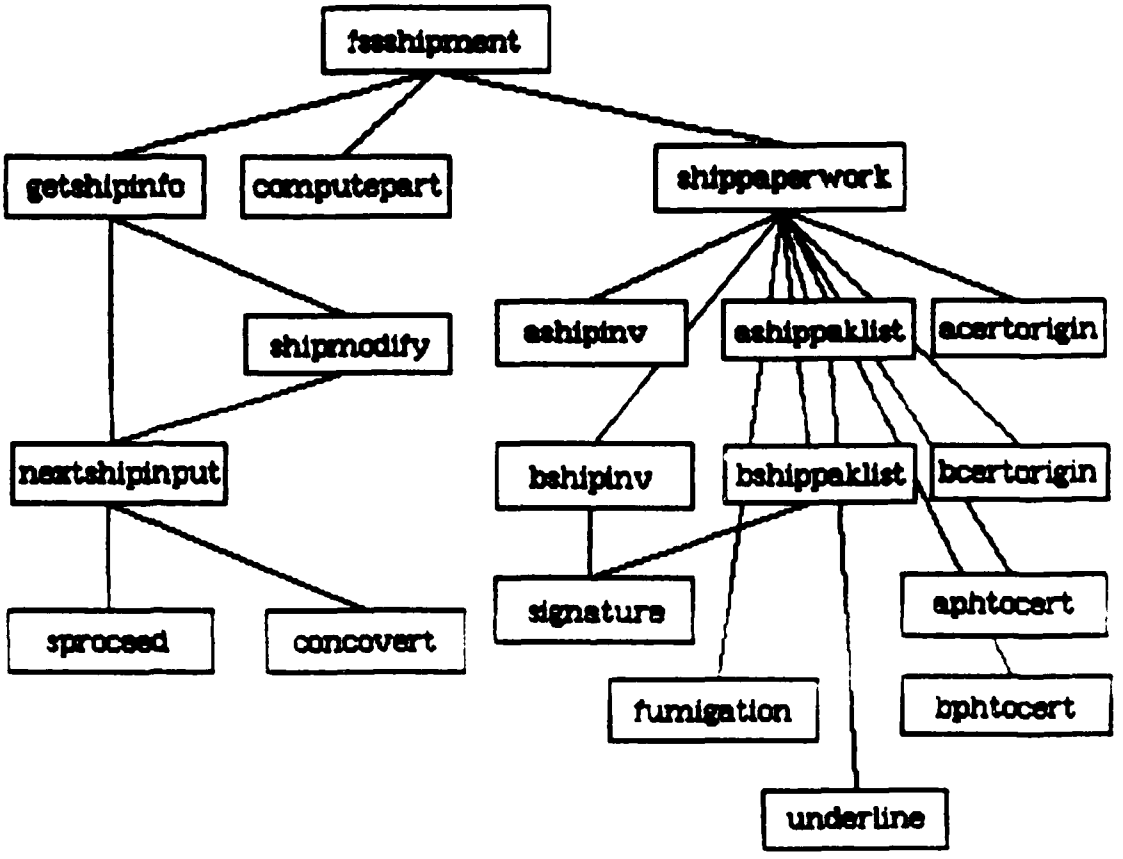


Figure 4-4 Structure diagram of FSSSHIPMENT

```
  PROCEDURE nextshipinput;
  { reads one input at a time }
  BEGIN
  END;

  PROCEDURE shipmodify;
  { re reads specified input once more }
  BEGIN
  END;

BEGIN
END;

PROCEDURE shippaperwork;
{ produces five documents pertaining one shipment }

   PROCEDURE signature;
   { write closing (like rubber stamp) }
   BEGIN
   END;

   PROCEDURE underline;
   { prints "-" for specified no of times }
   BEGIN
   END;

   PROCEDURE ashipinv;
   { top half of invoice }
   BEGIN
   END;

   PROCEDURE bshipinv;
   { bottom half of invoice }
   BEGIN
   END;

   PROCEDURE ashippaklist;
   { top half of packing list }
   BEGIN
   END;

   PROCEDURE bshippaklist;
   { bottom half of packing list }
   BEGIN
   END;

   PROCEDURE acertorigin;
   { top half of cert of origin }
   BEGIN
   END;

   PROCEDURE bcertorigin;
```

```
    { bottom half of cert of origin }
    BEGIN
    END;

    PROCEDURE aphytocert;
    { top half of phytosanitary cert }
    BEGIN
    END;

    PROCEDURE bphytocert;
    { bottom half of phytosanitary cert }
    BEGIN
    END;

    PROCEDURE fumigation;
    { fumigation certificate }
    BEGIN
    END;
  BEGIN { shippaperwork }
  END;
BEGIN
END.
```

```
*****************************************************************************
*                                FSSINQUERY                                 *
*****************************************************************************
```

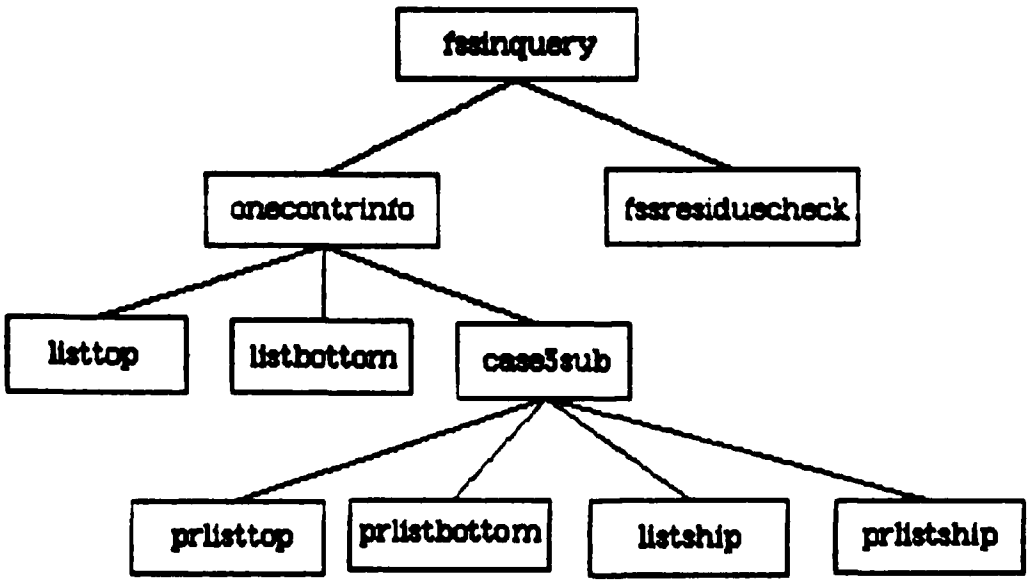


Figure 4-5 Structure diagram of FSSINQUERY

```
SEGMENT PROCEDURE fssinquery;
{ handles queries of following types:
```

```
  1. list all customers by company name.
  2. list all contracts of one customer.

  3. list all information (include all shipments made) of one
     contract
  4. list available spaces in FSSFILE and FSSSHIPFILE }

PROCEDURE listtop;
{ list top half of contract information }
BEGIN
END;

PROCEDURE listbottom;
{ list bottom half of contract information }
BEGIN
END;

PROCEDURE prlisttop;
{ same as listtop but outputs to printer }
BEGIN
END;

PROCEDURE prlistbottom;
BEGIN
END;

PROCEDURE listship;
{ list shipment info to console }
BEGIN
END;

PROCEDURE prlistship;
{ list shipment info to printer }
BEGIN
END;

PROCEDURE onecontrinfo;
{ handles query of type 3 }

   PROCEDURE case3sub;
    { handles the shipment info of one contract and printout of
    contract info to the printer }
   BEGIN
   END;
BEGIN
END;
```

```
  PROCEDURE residuecheck;
  { handles query of type 4 }
  BEGIN
  END;
BEGIN { FSSINQUERY }
END; { Note query 1 & 2 is handled in this main procedure }
```

2. Purchase

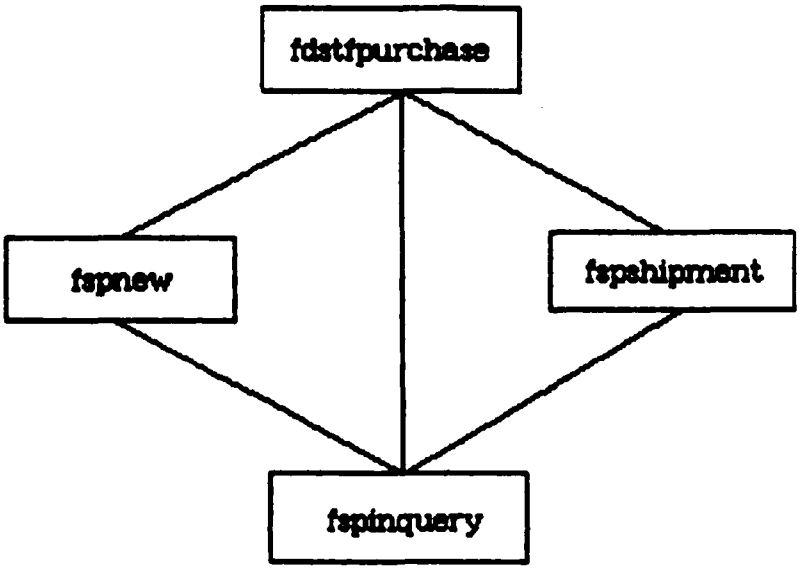


Figure 4-6 Structure diagram of Purchase

Followings are the program's outline of purchase:
(For details, please reference APPENDIX A)

```
======================== PURCHASE ========================

*************************************************************************
*                          MAIN PROGRAM                                 *
*************************************************************************

SEGMENT PROCEDURE fspinquery;
{ to prompt the query concerning the feed stuff purchase file }
BEGIN
END;

SEGMENT PROCEDURE fspnew;
{to input new purchase contract into the files }
BEGIN
END;
```

```
SEGMENT PROCEDURE fspshipment;
{ to input shipment information for the existing contract }
BEGIN
END;

PROCEDURE fdstfpurchase;
{ procedure to handle all operations concerning feed stuff purchase
}
BEGIN
END;

*****************************************************************************
*                                FSPNEW                                     *
*****************************************************************************
```

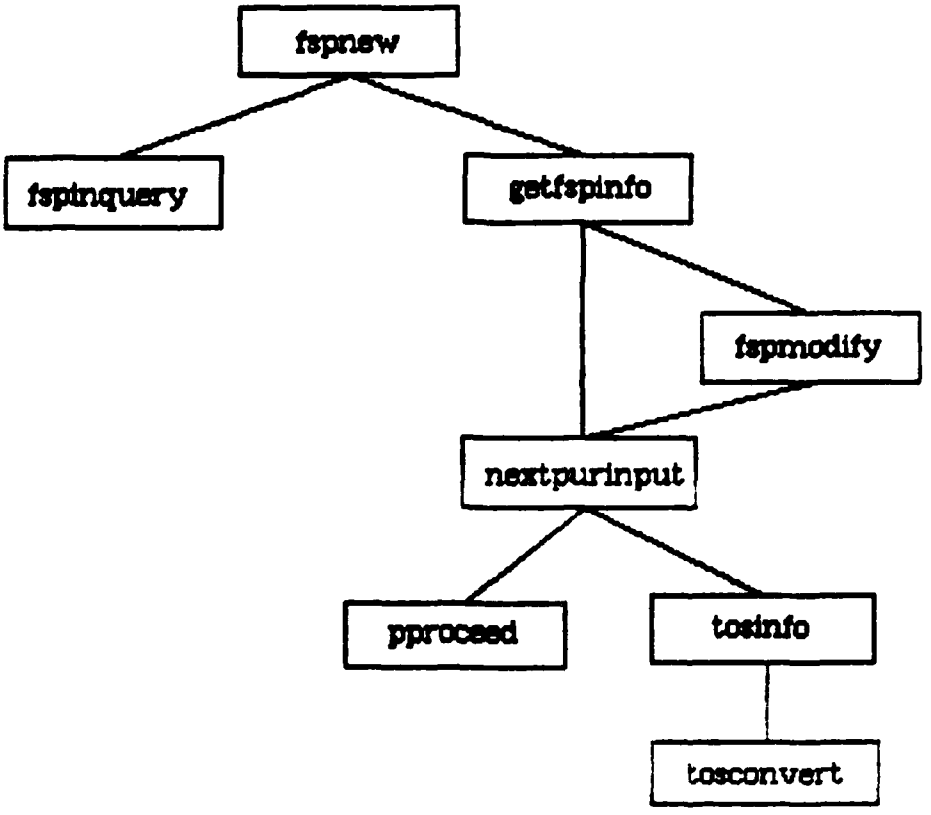


Figure 4-7 Structure diagram of FSPNEW

```
SEGMENT PROCEDURE fspnew;

  PROCEDURE tosconvert;
  { converts timeofship array input }
```

```
  BEGIN
  END;

  PROCEDURE getfspinfo;
  { input all pertinent info for new purchase contract }

      FUNCTION pproceed : boolean;
       { return true if the input line is not empty, so not to allow
         null input }
      BEGIN
      END;

      PROCEDURE tosinfo;
      { handles one input array timeofship, different proc since the
       input format differs from other input,i,e., makes procedure
       readnextinput too long }
      BEGIN
      END;

      PROCEDURE nextpurinput;
       { handles one input at a time, var lineno determines which
       input }
      BEGIN
      END;

      PROCEDURE fspmodify;
      { re reads any specified input once more }
      BEGIN
      END;
  BEGIN
  END;
BEGIN
END;

*****************************************************************************
*                                FSPSHIPMENT                                *
*****************************************************************************
SEGMENT PROCEDURE fspshipment;

  PROCEDURE truckconvert;
  { converts truck array input from string to approriate data type
   }
  BEGIN
  END;
```

```
PROCEDURE gettruckrate;
{ decides the price rate and convert into approriate data type }
BEGIN
END;
```

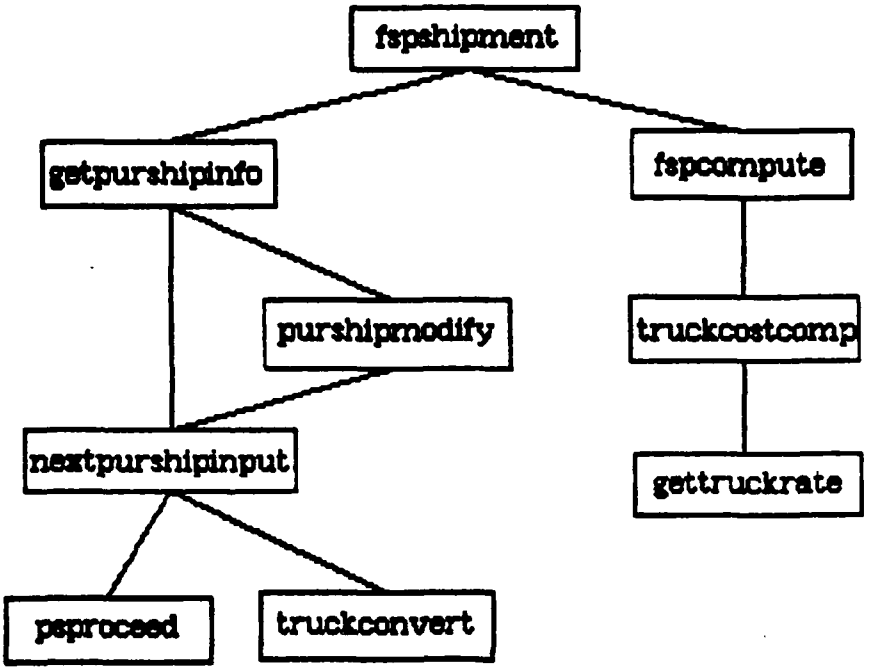


Figure 4-8 Structure diagram of FSPSHIPMENT

```
PROCEDURE truckcostcomp;
{ decide the rate base (lbs or short tons) and does the
 computation }
BEGIN
END;

PROCEDURE fspcompute;
{ compute the numeric data according the rates and bases }
BEGIN
END;

PROCEDURE getpurshipinfo;
{ get all pertinent info for a shipment }

   FUNCTION psproceed;
   { same as pproceed }
   BEGIN
```

```
    END;

    PROCEDURE nextpurshipinput;
    { reads one input at a time }
    BEGIN
    END;

    PROCEDURE purshipmodify;
    { re reads specified input once more }
    BEGIN
    END;
  BEGIN
  END;

*****************************************************************************
*                                FSPINQUERY                                 *
*****************************************************************************
  SEGMENT PROCEDURE listpurcontr;
  { list purchase contract to the console }
  BEGIN
  END;

  SEGMENT PROCEDURE prlistpurcontr;
  { list purchase contract to the printer }
  BEGIN
  END;
  SEGMENT PROCEDURE purcontrinfo;
  { list purchase shipment information }

    PROCEDURE listpurship;
    { list purchase shipment information to the console }
    BEGIN
    END;
    PROCEDURE printpurship;
    { list purchase shipment information to the printer }
    BEGIN
    END;

    PROCEDURE subpurcontr;
    { list shipment informations in sequence }
    BEGIN
    END;
   BEGIN
   END;
```

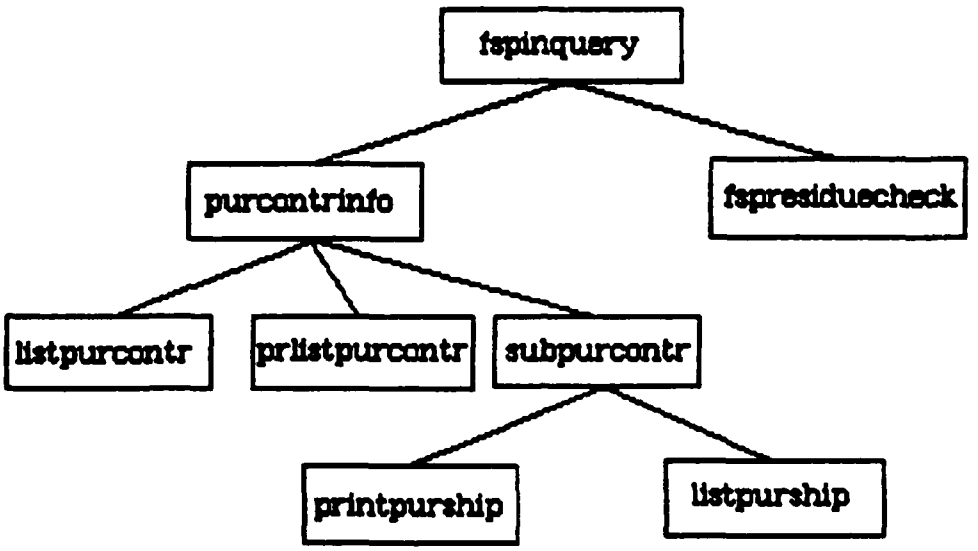


Figure 4-9 Structure diagram of FSPINQUERY

```
SEGMENT PROCEDURE fspresiduecheck;
{ handles query of type 4 }
BEGIN
END;

SEGMENT PROCEDURE fspinquery;
{ handles queries of following types:
   1. list all commodities.
   2. list all contracts of one commodities.
   3. list all information (include all shipments made) of one
      contract
   4. list available spaces in fspfile and fspshipfile }
 BEGIN
 END;
```

V. ANALYSIS AND DESIGN OF NEW PROGRAM

In order to use the dBASE III PLUS to rewrite the original program, we need to replace the existing set of files by its logical equivalent. The term " file structure, " refers to the complete set of stored data, its division into component sets, and the relationships that exist among those components. In most cases, the component sets are files or repeating groups within files. The relationships that exist among components include access keys, ordering techniques, redundancies, pointers, and so forth.

It is the whole file structure that must be logicalized. To talk about deriving logical equivalents of each current file is fruitless, because the very decision that some of these files should exist at all may have been physical. So we have to go back and think about the whole (the union of all data elements), and start from scratch to divide those files into its component pieces.

The process of dividing those files into its components is called **normalization**, which is a process to analyze the functional and multivalued data dependencies. The objective of normalization is to avoid redundancy and update, insert, and deletion anomalies. Each time we normalize a file, we replace a multipurpose file by two or more files. These files together can accomplish the same set of purposes as the original. The new files are always more singleminded than the one they replace. It frequently happens that the new equivalent files need to be normalized again.

There are different levels of normalization, named **1st normal form**, **2nd normal form**, **3rd normal form**, **BC normal form**, **4th normal form**, **5th normal form** and **domain/key normal form**.

A relation is in 1NF (1st normal form) if it contains no repeating groups. It is a simple matter to produce 1NF from an unnormalized relation.

A relation is in 2NF if it is in 1NF and there are no partial dependencies.

A relation is in 3NF if it is in 2NF and there are no transitive dependencies. For most practical databases, 3NF is sufficient.

A relation is in BCNF (Boyce Codd) if it is in 3NF and every determinent is a candidate key.

A relation is in 4NF if it is in BCNF and there are no multivalued dependencies.

Before rewriting the original program, we have to normalize the relations of the files used in the original program, then use those normalized logical file structures to create new Entity-Relational diagrams and a new relational database written with dBASE III PLUS.

A. NORMALIZATION OF SALES

As we can see in Appendix A, the file structures declared in the original program are listed as follows:

FSSFILE { Status, Number, ContrDate, Customer.Name, Customer.Addr, Customer.ContrNo, Commodity, Pricebase, Lc.Number, Lc.ExpDate, Lc.ShipDate, Lc.Bal, Lc.Amount, TimeOfShip, TotalShip, BalOfShip, IssueBank, DrawBank, MitiNo, NofShipment, ShipmentInfo}

TimeOfShip { Month, Wgt, Bal, UnitPrice }

FSSHASHFILE { Status, Number, Name, Commodity, Link}

FSSSHIPFILE { Status, InvoiceNo, Name, Origin, Dest, Etd, InvoiceDate, TotalBales, TotalNet, Container, NofCont}

Container { Number, Bales, Net }

FSSCONTRACT { same as FSSFILE }

FSSDUMMY { same as FSSFILE }

FSSSHIPREC { same as FSSSHIPFILE }

1. 1st Normal Form

There are three file structures used in **Sales**, with two repeating groups in FSSFILE (as indicated with underline) and one repeating group in FSSSHIPFILE. One temporary file FSSHASHFILE is used as an intermediate file to map into FSSFILE for updating or inserting records. This is not necessary in the relational database.

The field STATUS in FSSFILE and FSSSHIPFILE is used to keep track of the space allocation. In dBASE III PLUS, the APPEND and INSERT take care of this. Again we can eliminate these from the files. The field SHIPMENTINFO is used as a pointer to point to the shipment information. Actually it is used to create the relationship between FSSFILE and FSSSHIPMENT. Again we can eliminate this, because in the relational database, a relation can be created by using the same primary key.

To put these files in 1NF, the repeating groups must be removed from within these files. After 1st normalization, we have these new relations:

FSSFILE { Number, ContrDate, Customer.Name, Customer.Addr, Customer.ContrNo, Commodity, Pricebase, Lc.Number, Lc.ExpDate, Lc.ShipDate, Lc.Bal, Lc.Amount, TotalShip, BalOfShip, IssueBank, DrawBank, MitiNo, NotShipment }

FSSSHIPFILE { InvoiceNo, Name, Origin, Dest, Etd, InvoiceDate, TotalBales, TotalNet, NofCont }

CONTAINER { Number, Bales, Net }

TIMEOFSHIP { Month, Wgt, Bal, UnitPrice }

2. 2nd Normal Form

We have separated repeating groups from files, and we need to create relations between these new files. In TIMEOFSHIP, the field MONTH could be a primary key, but the month can be repeated every year. So, we can compose NUMBER from FSSFILE with MONTH as a primary key (indicated with underline), because TIMEOFSHIP is separated from FSSFILE.

Since we delete SHIPMENTINFO (a pointer) from FSSFILE, we lost the relation with FSSSHIPFILE. We need to put a field to connect FSSFILE and FSSSHIPFILE. We can use the unique NUMBER in FSSFILE to be the foreign key in FSSSHIPFILE (indicated by postfixing a *).

The same thing happened with CONTAINER. Number can be composed from CONTAINER with InvoiceNo from FSSFILE as the primary key in CONTAINER to avoid those anomalies.

But here we have problems with 1NF. First, the redundancy, customer records are in FSSFILE, and one customer can have many sales information records in FSSFILE. So each time we have new sales contract with the same customer, we have to put in the redundant customer's data. Second, the insertion anomalies, new customers cannot be added until they have signed a sales contract with the company. Third, deletion anomalies, delete a sales contract could delete all the information of a customer if that customer has only one sales contract with the company.

So, we need to go through 2NF, to eliminate the dependencies mentioned above. We separate the customer record from FSSFILE. Now the relations are like the following:

CUSTOMER { Name, Addr, ContrNo }

FSSFILE { Number, ContrDate, Commodity, PriceBase, Lc.Number, Lc.ExpDate, Lc.ShipDate, Lc.Bal, Lc.Amount, TotalShip, BalofShip, IssueBank, DrawBank, MitiNo, NofShipment }

FSSSHIPFILE { InvoiceNo, Name, Origin, Dest, Etd, InvoiceDate, TotalBales, TotalNet, NofCont, Number* }

CONTAINER { Number, InvoiceNo, Bales, Net }

TIMEOFSHIP { Number, Month, Wgt, Bal, UnitPrice }

3. 3rd Normal Form

A relation is in 3NF if it is in 2NF and there is no transitive dependency. As we can see in the relations above, there is no transitive dependency. These relations are already in 3NF.

But, the CUSTOMER was just separated from FSSFILE, and there is no relation between CUSTOMER and FSSFILE. Perhaps the field CONTRNO in CUSTOMER can be used as a primary key. This could cause deletion anomalies, if we delete a record in FSSFILE, we might lose the record of CUSTOMER.

To avoid these problems, we can introduce the field NAME in CUSTOMER to be a foreign key in FSSFILE (indicated by postfixing with a *).

CUSTOMER { Name, Addr }

FSSFILE { Number, ContrDate, Commodity, PriceBase, Lc.Number, Lc.ExpDate, Lc.ShipDate, Lc.Bal, Lc.Amount, TotalShip, BalofShip, IssueBank, DrawBank, MitiNo, NofShipment, Name* }

FSSSHIPFILE { InvoiceNo, Name, Origin, Dest, Etd, InvoiceDate, TotalBales, TotalNet, NofCont, Number* }

CONTAINER { Number, InvoiceNo, Bales, Net }

TIMEOFSHIP { Number, Month, Wgt, Bal, UnitPrice }

We added one more field named PhoneNo to CUSTOMER to make it more useful. Then we renamed those file names and field names to make them more meaningful. The final result is:

Customer (cname, addr, phoneno)

S-Contract (snumber, contrdate, commodity, pricebase,
lcnumber, lcexpdate, lcshipdate, lcbal, lcamount
totalship, balofship, issuebank, drawbank, mitino,
nofshipment, cname*)

Timeofshipment (month, snumebr, wgt, bal, unitprice)

S_Shipment (invoiceno, name, origin, dest, etd, invoicedate,
totalbales, totalnet, nofcont, snumber*)

Container (cnumber, invoiceno, bales, net)

4. New E-R Diagram

Until now, we can draw a new Entity-Relational diagram (Figure 5-2) with the developed relations. As you can see the Entity-Relational diagram of the new program is much more simple and readable than that of the old program.

5. New Data Structures

Also, we used those relations to create data structures for the new program with the convention of dBASE III PLUS.

S-Contract

Field Name	Type	Width	Dec

ContrDate	Character	8	
Commodity	Character	50	
PriceBase	Character	80	
LcNumber	Character	12	
LcExpDate	Character	8	
LcShipDate	Character	8	
LcBal	Numeric	15	2
LcAmount	Numeric	15	2
TotalShip	Numeric	15	2
BalofShip	Numeric	15	2
IssueBank	Character	30	
DrawBank	Character	30	
MitiNo	Character	18	
NofShipment	Numeric	15	
CName	Character	25	

S-Shipment

Field Name	Type	Width	Dec
InvoiceNo	Character	15	
Name	Character	25	
Origin	Character	25	
Dest	Character	25	
Etd	Character	8	
InvoiceDate	Character	8	

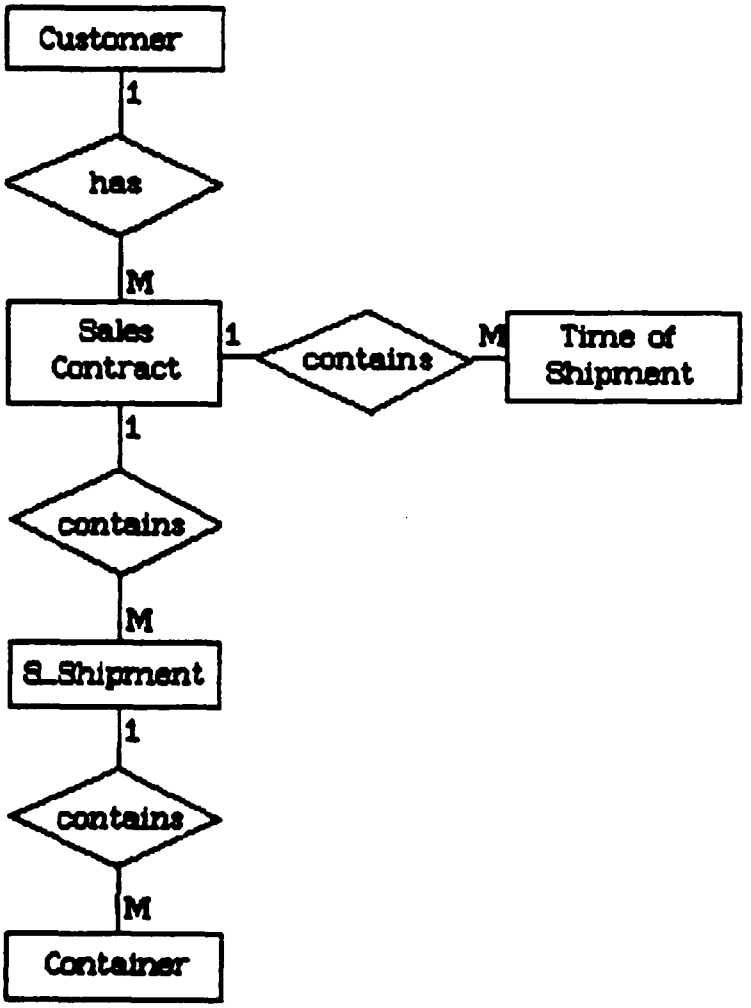


Figure 5-1 New E-R Diagram of Sales

TotalBales	Numeric	15	2
TotalNet	Numeric	15	2
NofContner	Numeric	15	
SNumber	Character	12	

TimeofShipment

Field Name	Type	Width	Dec
Month	Character	2	
SNumber	Character	12	

Wgt	Numeric	15	2
Bal	Numeric	15	2
UnitPrice	Numeric	15	2

Customer

Field Name	Type	Width	Dec
CName	Character	25	
Address	Character	50	
PhoneNo	Character	13	

Container

Field Name	Type	Width	Dec
CNumber	Character	12	
InvoiceNo	Character	15	
Bales	Numeric	15	2
Net	Numeric	15	2

B. NORMALIZATION OF PURCHASE

With all the procedures we applied to the **Sales**, we have a more simple, more structured relational database of **Sales**. We can applied these procedures to the **Purchase** too. The following are the results when we went through the **Purchase** with normalization, E-R diagram, and redefined data structures.

First, we study the file structures declared in the original program.

FSPFILE { Status, Number, ContrDate, Farmer.Name,
Farmer.Addr, Commodity, TimeofShip, TotalShip, BalofShip,
Nofshipment, ShipmentInfo }

TIMEOFSHIP { Month, Wgt, Bal, UnitPrice }

FSPHASHFILE { Status, Number, Name, Commodity, Link }

FSPSHIPFILE { Status, Truck, NofTruck, TotalBales, TotalNet,
Payment, TotalTruckCost, Link }

TRUCK { MthDay, WgtTicketNo, Bales, Net, Cost }

FSPCONTRACT { Same as FSPFILE }

FSPSHIPREC { Same as FSPSHIPFILE }

1. 1st Normal Form

For the same reasons in **Sales**, we deleted FSPCONTRACT and FSPSHIPREC, and eliminated fields STATUS, LINK, SHIPMENTINFO. Besides, the Number in FSPFILE is purchase number, so we substituted with the new field name PNumber.

Now, the new file structures look like these:

FSPFILE { PNumber, ContrDate, Farmer.Name, Farmer.Addr,
Commodity, TimeofShip, TotalShip, BalofShip, Nofshipment
}

TIMEOFSHIP { Month, Wgt, Bal, UnitPrice }

FSPSHIPFILE { Truck, NofTruck, TotalBales, TotalNet, Payment,
TotalTruckCost }

TRUCK { MthDay, WgtTicketNo, Bales, Net, Cost }

After the 1st Normal Form

FSPFILE { PNumber, ContrDate, Farmer.Name, Farmer.Addr,
Commodity, TotalShip, BalofShip, Nofshipment }

TIMEOFSHIP { Month, Wgt, Bal, UnitPrice }

FSPSHIPFILE { NofTruck, TotalBales, TotalNet, Payment,
TotalTruckCost }

TRUCK { MthDay, WgtTicketNo, Bales, Net, Cost }

2. 2nd Normal Form

After the 2nd Normal Form and creating the new relations with newly separated files :

FARMER { Name, Addr }

FSPFILE { Number, ContrDate, Farmer.Name, Farmer.Addr,
Commodity, TotalShip, BalofShip, Nofshipment }

TIMEOFSHIP { PNumber, Month, Wgt, Bal, UnitPrice }

FSPSHIPFILE { PNumber,PShipNo, NofTruck, TotalBales, TotalNet,
Payment, TotalTruckCost }

TRUCK { PNumber, PShipNo, MthDay, WgtTicketNo, Bales, Net, Cost
}

3. 3rd Normal Form

Here we meet the same problem as we did in **Sale**. The FARMER just separated from FSPFILE, we created a new relation between FARMER and FSPFILE.

FARMER { Name, Addr }

FSPFILE { PNumber, ContrDate, Farmer.Name, Farmer.Addr,
Commodity, TotalShip, BalofShip, Nofshipment, Name* }

TIMEOFSHIP { PNumber, Month, Wgt, Bal, UnitPrice }

FSPSHIPFILE { PNumber,PShipNo, NofTruck, TotalBales, TotalNet,
Payment, TotalTruckCost }

TRUCK { PNumber, PShipNo, MthDay, WgtTicketNo, Bales, Net, Cost

}

Again, we put PhoneNo in FARMER to make it more flexible. We changed the file names and field names to make them more meaningful. Then, these are the final result:

Farmer (fname, addr, phoneno)

Purchase_Contract (pnumber, contrdate, commodity, totalship, balofship, nofshipment, fname*)

P_Shipment (pshipno, pnumber, noftruck, totalbales, totalnet, payment, totaltruckcost)

TimeOfShip (pnumber, month, wgt, bal, unitprice)

Truck (pshipno, pnumber, mthday, wgtticketno, bales, net, cost)

4. New E-R Diagram

With the new relations, we draw a new Entity-Relational diagram, which looks like the E-R diagram of **Sales**. (on next page)

5. New Data Structures

P-Contract

Field Name	Type	Width	Dec
PNumber	Character	12	
ContrDate	Character	8	
Commodity	Character	50	
TotalShip	Numeric	15	2
BalofShip	Numeric	15	2
NofShipment	Numeric	5	
FName	Character	25	

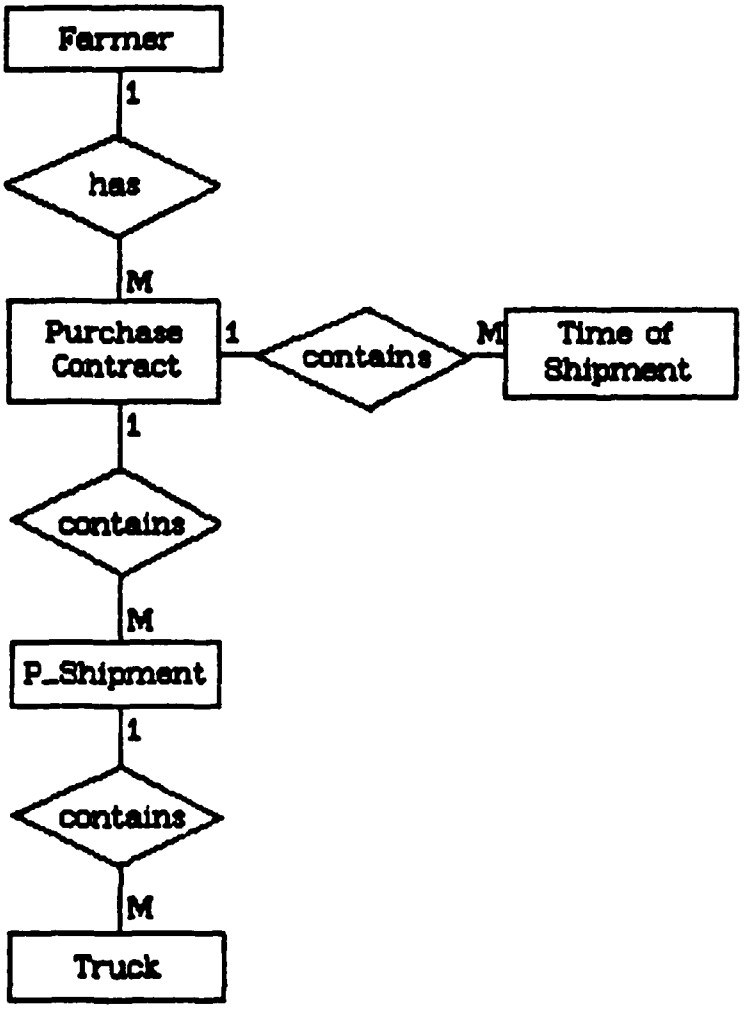


Figure 5-2 New E-R Diagram of Purchase

P-Shipment

Field Name	Type	Width	Dec
PShipNo	Character	12	
PNumber	Character	12	
NofTruck	Numeric	2	
TotalBales	Numeric	15	2
TotalNet	Numeric	15	2
Payment	Numeric	15	2

TruckCost	Numeric	15	2

Farmer

Field Name	Type	Width	Dec
FName	Character	25	
Address	Character	50	
PhoneNo	Character	13	

Truck

Field Name	Type	Width	Dec
PShipNo	Character	12	
PNumber	Character	12	
MthDay	Character	8	
WgtTicketNo	Character	12	
Bales	Numeric	15	2
Net	Numeric	15	2
Cost	Numeric	15	2

VI. STUDY OF MAINTAINABILITY OF THESE TWO PROGRAMS

The term "maintainability" is used to describe the ability of a software activity that occurs following the delivery of that software product to the customer. A software product possesses the characteristic MAINTAINABILITY to the extent that it facilitates updating to satisfy new requirements.

A maintainable software product is one which is understandable, testable, and easy to modify. One must be able to modify the product to rectify a deficiency or to add new capabilities or to allow a program to operate on a different computer system.

The maintenance phase of the software life cycle is the time period in which a software product performs useful work. Typically, the maintenance phase in the life cycle for a software product spans longer than that for the development phase.

Maintainability concerning the ability of a software being making enhancements to that software products, adapting products to new environments, and correcting problems. Software product enhancements can involve providing new functional capabilities, improving user displays, and modes of interaction, or upgrading the performance characteristics of a system. Adaption of software to a new environment can involve moving the software to a different machine. Problem correction involves modification and revalidation of software to correct errors. Also, the changing requirements from users can cost much in maintaining software.

In most software engineering studies, it is shown that maintainence activities actually break into three main subactivities. They are : **Perfective Maintenance, Adaptive Maintenance**, and **Corrective Maintenance**.

Perfective maintenance is the act of improving the software's function by responding to customer- and programmer-defined changes. This is not the portion of software maintenance that is involved with fixing errors. But it is the biggest maintenance time consumer.

Adaptive maintenance is the act of changing software to adapt to environmental changes. If the computer on which the software runs is going to get a new version of the operating system, or the total system data base must have some detail level changes (for example, if the ZIP code is increased from five to nine digits), the software must be adapted to meet those changes.

Corrective maintenance is the act of keeping software free from errors and guarantees the integrity of data.

A. THE ORIGINAL PROGRAM

1. Maintainability of Record Structures

In the original program, the data structures used in defining files are records. As we know that Pascal has very strong typing, this means that the records used to define files have domain constraints. A domain constraint simply states that values of the attribute in question are required to belong to the set of values constituting the underlying domain. Here we discuss the maintainability of the original program and the new program by checking the record structures and control structures

a. Add Fields

Referring to the records and file declarations of the original program in Appendix A, we can summarize them as follow:

SALE'S FILE DECLARATIONS

```
fssfile : FILE OF fsstype;
fsshashfile : FILE OF entry;
fssshipfile : FILE OF shiptype;
fsscontract, fssdummy : fsstype;
fssshiprec : shiptype;
```

Now, there are one file (i.e,. fssfile) and two file buffers (i,e., fsscontract, fssdummy) using the same data structures:

```
fsstype = PACKER RECORD
            status : statustype;
            number : string[12];
            contrdate : datetype;
            customer : customertype;
            commodity : string[50];
            pricebase : string[80];
            lc        : lctype;
            timeofship : ARRAY[1..7] OF tostype;
            totalship, balofship : real;
            issuebank, drawbank : string[30];
            mitino : string[18];
            nofshipment : integer;
            shipmentinfo : integer;
          END;
```

Within this record structure, there are five different user-defined data types:

```
statustype = (occupied, empty);

datetype = PACKED RECORD
             month,
             day,
             year   integer.
           END;

customtype = PACKED RECORD
               name : string[25];
               addr   string[50],
               contrno : string[12],
             END;
```

```
lctype   = PACKED RECORD
                number : string[12];
                expdate,
                shipdate : datetype;
                bal,amount : real;
           END;

tostype = PACKED RECORD
                month,wgt : integer;
                bal,unitprice : real;
           END;
```

What is interesting is that inside **lctype**, there is a **datetype**. Now **datetype** has been referenced in a different hierarchical level. Suppose we are going to put a new field, say TIME, in **datetype**, and suppose that we only use TIME in **contrdate**, not in **lctype**. This causes some troubles. First, we have to define a new type, say **datetimetype**, which has an extra field that contains the time of the event. Second, we need to write another user-defined function to check **datetimetype** besides function DATECHECK. Third, we need one more procedure to convert **datetimetype** besides procedure DATECONVERT. Fourth, after all this has been done, we need to recompile the source program, redebug, recompile, redebug, and so on. Also, within FSSNEW, in READNEXTINPUT, we have to modify statements to meet the new data types.

The same problems occur if we want to add one field, say phone number, to **customtype**.

Now, lets have a look at another file structure in **Sale**, which is referenced by **fssshipfile** and **fssshiprec**

```
shiptype = PACKED RECORD
                status : statustype;
                involveno : string[15];
                name,
                origin,
                dest : string[25],
```

```
        etd,
        invoicedate : datetype;
        totalbales : integer;
        totalnet : real;
        container : ARRAY[1..20] OF contype;
        nofcont : 0..20;
        link : integer;
    END;
```

In this file type, three user-defined data types being referenced

```
statustype = (occupied, empty);

datetype = PACKED RECORD
            month,
            day,
            year : integer;
        END;

contype = PACKED RECORD
            number : string[12];
            bales : integer;
            net : real;
        END;
```

The same situations have to be considered if we want to add fields into these three data types or the file type.

b. Delete Fields

What will happen if we delete the field **year** from **datetype**, or delete **contrno** from **customtype** ? How much trouble can it cause ? The same as above ? Will we lose all the data kept in that field? Of course. There is no way to prevent this, even an experienced programmer uses structured-programming techniques such as Information Hiding. The reason is, Pascal was designed for general programming environments, peoples can use Pascal to design an Operating System, or a compiler, or a database system or any other programs that meet scientific or business requirements.

Same problems happen with **Purchase** Let's look at Appendix A

PURCHASE'S FILE DECLARATIONS

```
fspfile   FILE OF fsptype,
fsphashfile   FILE OF entry,
fspshipfile   FILE OF fspshiptype,
fspcontract   fsptype;
fspshiprec   fspshiptype;
```

Again, there are one file (i e, fspfile) and one file buffer (i,e , fspcontract) using the same file type

```
fsptype = PACKED RECORD
            status   statustype;
            number   string[12],
            contrdate   datetype;
            farmer   farmertype;
            commodity   string[50];
            timeofship   ARRAY[1..7] OF tostype,
            totalship,
            balofship   real;
            nofshipment,
            shipmentinfo   integer;
          END;
```

Within this record type, there are five different user-defined data types

```
statustype = (occupied, empty),

datetype = PACKED RECORD
             month,
             day,
             year   integer;
           END;

farmertype = PACKED RECORD
             name   string[25],
             addr   string[50],
```

```
                END;

        tostype = PACKED RECORD
                        month, wgt : integer;
                        bal, unitprice : real;
                END;
```

The same discussions can be used here as we used in **Sales**. We have the same conclusions

B. THE NEW PROGRAM

dBASE III PLUS is a versatile database manager. It is designed to handle the many business applications in which the user needs to manage large amounts of repetitive information. It can function as a simple file manager, it can handle the complex issues in relating files to one another, and it can be used as a complete computer language like Pascal or BASIC. Its fast development means that appropriate jobs can be completed in much less time with dBASE III PLUS than with Pascal or BASIC. It is possible to stop and start dBASE III PLUS between instructions and so have a microscope into the commands. Pascal and BASIC are compiled, so if things go wrong, it is very hard to discover where the mistake was made. In dBASE III PLUS, when changes are made the results appear instantaneously. From the dBASE III PLUS prompt, it is possible to go anywhere and see anything. Everything is open to instant inspection and change. This kind of power can be its own problem. dBASE III PLUS has the disadvantage of being a highly accessible language. You can always single step your way through your command files, make never ending, instantaneous changes with MODIFY COMMAND, etc.

dBASE III PLUS has sophisticated yet easy indexing. This means

that a list can be organized in several different ways simultaneously and that any item can be found in a fraction of a second in a small list (says less than 2000 records) and only a few seconds in a list of many thousands of records

dBASE III PLUS is far from a perfect programming system Frequently there are bugs where the program simply does not do what it is supposed to do

1 Maintainability of Record Structures

a Add Fields

dBASE III PLUS fully supports the **Relational Data Model** The files are created as two dimensional tables At dBASE III PLUS dot prompt, just type in

CREATE <filename>

The effect of this action is that dBASE III PLUS sets up a screen layout, expecting your file-definition entries You just provide information for that file At this point, dBASE III PLUS wants you to specify the **name** of each field you want to define, the **type** of the field, the **length** of the field, and the number of **decimal** places, if the field is a numeric field Here is an example of file structure CUSTOMER used in **sale**

```
Structure for database : A:customer.dbf
Number of data records:        0
Date of last update    :    05/01/87
Field    Field Name    Type         Width     Dec
1        CNAME         Character    25
2        ADDRESS       Character    50
3        PHONENO       Character    13
** Total **                         89
```

Perhaps you want to change the structure of one of the existing fields, maybe a name change, a type change, or a length change), or perhaps you want to add one more field into the

structure Regardless of the kind of change you want, it would logical to make changes anytime This does not mean, however, that you cannot alter the structure of an existing database that contains data records You can change structures at any time, in any database

To add a field in this file structure, enter

USE CUSTOMER <cr> (Not necessary if the file is already in use)

MODIFY STRUCTURE <cr> or

MODI STRU

This brings up the structure of the file on the screen Then use the combination of cursor controls to add a new field When you have made the required changes to your structure, you can either enter Ctrl-W or Ctrl-END to save the new structure, or enter Ctrl-Q or ESC to change your mind on the changes made You don't have to re-compile the program

Of course if you have just created a new file and there are no data records in it, you can modify its structure at will, without any adverse effects Yet, the most important consideration - Future change Future changes to data files in a database should be anticipated as much as possible in order to buffer the amount of restructuring required Future changes encompass three areas hidden keys, addition of dependent fields, and high-usage of a secondary key

Hidden Keys

Each of the dependent fields in a data file should be examined to determined whether any might become key fields in the future If they are identified, they can either be removed from the data file and added to a new data file or left in the

existing data file, as long as flexibility is provided to accommodate future key field changes.

Addition of Dependent Fields

The data file structures should have room for the addition of dependent fields. Even though this will require reloading of the records whenever new fields are added, it should not affect the application program written.

High-Usage of Secondary Key

If you anticipate that a dependent field acting on occasion as a key field will be used more in the future, the data file structures and application programs should be designed to accomodate change. This may require the dividing of the data file into two data files at the very start, or the writing of the application programs to accept this anticipated future change

b. Delete Fields

To delete a field from data file in database, the above strategies can be applied. But when we delete a field, the data retained for that field will be gone, unless you rename the field name or copy that record data to some temporary store areas.

To delete a field, we have to be cautious about if it is a primary key of a file or not. dBASE III PLUS has a very important feature called **INDEXING**. Indexing is an inherent part of the dBASE III PLUS scenario. If your goal is to write sophisticated application programs, you cannot do so without the indexing feature.

In the process of INDEXing, you inform dBASE III PLUS of

your intention to create an **index file** on one or more of the fields of the master file you are working with.

Index file is created as follow :

.USE CUSTOMER <cr>

.INDEX ON CNAME TO CUSTINDX <cr>

This results in the creation of a separate file called an **index file**, whose name is CUSTINDX. You can provide any primary name you want. dBASE III PLUS provides the default extension of .NDX. An index file is just an index file. It is not a dBASE III PLUS database. It only contains pointers to the actual records in the data files.

Now, suppose you want to delete the field called CNAME! What is going to happen? How can CUSTINDX index on? Will you lose all the data records? Without that field which the index file indexed on, you cannot manipulate that file, like DISPLAY, LIST, PRINT, etc,. You have lost them. So, before you delete CNAME you might want to re-index the CUSTOMER on another field. You can then delete CNAME.

2. Modifying Functions in Pascal Program

Pascal is a block-structured language, and a block-structured language requires the develpoment of new run-time techniques. Since Pascal procedures can be recursive, there can be several instances of a procedure active at one time. Hence there must be some provision for the dynamic creation of activation records to hold the state of these instances. Therefore, the static "one activation record per procedure" techniques will not work. Also, we have seen that Pascal provides dynamic memory management by allocating space for the locals of a procedure on a stack. This storage is allocated on procedure entry and deallocated on procedure exit. This means that variables cannot be statically bound to memory locations as is common in FORTRAN and assembly languages. In Pascal, activation records represent the state of an activation. Procedures require both static and dynamic links. The static link is set to the environment of definition and the dynamic link points to its context. Procedural parameters are represented by closures. Pascal, Algol, and many other languages allow procedures and functions to be passed as arguments to other procedures and functions. Allowing functions to accept and return other functions leads to a very powerful style of programming, called **functional programming**. Functional programming languages must use a different discipline for the allocation and deallocation of activation records.

So far, we have studied the various of data typing, various discipline of memory allocation and various considerations of procedure calling and return. We know once we have developed a program for one application, its tied up to that application. It is very difficult to add one function or eliminate one function from

that program. Because, all the procedures are dependent on each other, and all the data declarations, all the programming codes was so program dependent.

B. MODIFIABILITY OF dBASE III PLUS

1. Modifying Data Fields in dBASE III PLUS Program

If you are modifying the structure of an existing database that has data-records in it, note that you should choose your modification cautiously. Consider the following situation. Suppose we have a character field called SNUMBER that has, as data, a combination of digits and characters, starting with digits, and you want to change its type to numeric. Since dBASE III PLUS will not retain character data in a numeric field, at the end of the modification, we will have lost all the character data from that SNUMBER field! Only the leading numerics will be retained in the (new) numeric field. If the original data had leading characters instead of numerics, nothing would have been retained.

If you change a field name and a field length at the same time, (either in the same or different fields), note that we will lose the data for the field(s) with the name change! Since dBASE III PLUS cannot handle this dual-change at the same time, make one of the changes first (either one) and then make the other change to modify the structure.

If you change the name of a field (only), and you want to save this new structure, dBASE III PLUS will ask you a question "Should data be COPIED from backup for all fields?(Y/N)". What this means is that, by default, when you change the name of a field, you will lose all your data from all the records for the specific field, at the end of modification. By responding with a Y to this question, you can retain all your data for all the records for that

field, at the end of name-change modification.

To modify the structure of the database you have created, just enter at the dBASE III PLUS dot prompt :

```
.USE CUSTOMER          <cr>
.MODIFY STRUCTURE      <cr>      or
.MODI STRU             <cr>
```

MODIFY COMMAND is dBASE III PLUS' text editor. It is crude by text-editing standards, but it has one major advantage: it can be accessed directly from dBASE III PLUS.

Part of dBASE III PLUS' appeal is that changes can be made to a program very quickly. The MODIFY COMMAND allows programmers to alter command files and test the changes in as fast a way as possible. It is especially useful after a program is written, when the program then needs to be debugged. During this stage simple bugs, spelling mistakes, and syntax errors predominate. These usually require only a little thought, and the ability to get to a text editor quickly is extremely valuable.

Because it is a very simple text editor, the more a change needs sophisticated editing, the less appealing MODIFY COMMAND will be. If the programmer wishes to move commands from one place to another, to copy groups of command, or to search the command file, then MODIFY COMMAND is a poor tool.

The MODIFY COMMAND has about 20 commands. It uses WordStar-like commands. There are two major problems with MODIFY COMMAND (in addition to all the features it lacks) First, it only allows command files of about 4,096 characters. If programmers go beyond this limit, then a message will be received saying that data will be lost if they try to save the file Second, if the user deletes a line or if a character is inserted into a large file, it takes an annoyingly long time to rewrite the screen.

By today's standards, the MODIFY COMMAND is crude, and many find it a source of irritation. But as an old dBASE and CBASIC programmer, the MODIFY COMMAND was revolutionary when it first appeared. Prior to that, all programs had to exit from their program (e.g.,Pascal), go to the Operating System, then to their word processor, again to the Operating System, and then back to the program. Each change in a program required the same lengthy journey. All this was obviated by the MODIFY COMMAND.

2. Modifying Functions in dBASE III PLUS Program

Here what we discuss is how to add or delete an application to or from a database. There are tremendous benefits to be gained by subdividing a problem into several command files. But there are some differences between writing a single command file and writing a project in several command files. These differences only concern memory variables in dBASE III PLUS; they involve no restrictions on data and index files.

The major benefit is that thinking can be organized by breaking the job into a series of tasks, each of which is performed by a command file. This makes development and testing easier, and makes adding and deleting functions or applications easier. Provided that the task of dividing the main task into subtasks has been properly thought through, the program will be more flexible and changes will be easier to implement than if the entire task was performed in one command file.

There is a convention that a command file that calls another command file is at a higher level. The command file that is called is at a lower level than the command file calling it. dBASE III PLUS can move up or down the structure of command files, to higher or lower level command files. It cannot move sideways.

When a task is performed across a number of command files, dBASE III PLUS generally will perform more slowly than if all commands were in one file. This is because each command file has to be opened by DOS when a DO (a command in dBASE III PLUS) is performed and closed by DOS when a RETURN is performed. The time taken for this can be considerable. SET PROCEDURE will circumvent the opening and closing of files by DOS.

In the new program, we subdivided the old program into severel subprograms and tied up with the E-R diagram of the new program in five levels (see Figure 5-2 and Figure 5-3), they are:

HANAOKA

SALE

NEW SALE CONTRACT

SALE INFORMATION INQUERY

NEW SALE SHIPMENT

SCOMPUTE

SALE INFORMATION INQUERY

LIST CUSTOMER

LIST ALL CONTRACTS OF ONE CUSTOMER

LIST ONE CONTRACT INFORMATION

SALE LIST

PURCHASE

NEW PURCHASE CONTRACT

PURCHASE INFORMATION INQUERY

NEW PURCHASE SHIPMENT

PCOMPUTE

PURCHASE INFORMATION INQUERY

PURCHASE LIST

PURCHASE SHIPMENT LIST

The name at each line represents a command file. Totally

there are 19 command files in the new program. All the command files are independent of each other. One command file has one function only, so it's easy for programmer to delete a command file if that function or application is no longer necessary. The programmer can add a function or application to this program by creating a command file for that function or application.

VIII CONCLUSIONS

The increasing productivity of systems development, the shortening of the response time of the computer, and the increasing complexity of computer systems, requires effective tools that will be capable of processing information. Many changes have occurred in the last five years. These changes are of two fundamental types. First, people have learned how to better manage and use database technology. Five years ago, companies were still wrestling with databases. With no powerful database language available, they used generic programming languages to implement databases. To use generic programming languages to simulate relational database model or for any Database Management System is quite a heavy job. Some advantages of a database must be sacrified due to the lack of database features.

In 1981, this situation changed. Some of the database languages, based on the relational model, were announced as products. Early relational products had unacceptable performance. In the last two years, performance has been improved. Major manufacturing organizations have tested relational DBMS products and have found segments of their workload that can be processed with acceptable performance. Using a relational DBMS, one company found application development productivity improvements to be greater than 100 to 1.

In this study, we examined two programs, one was written in Pascal, and the other was written in dBASE III PLUS. We can compare the lines of the source code of these two programs (see Appendix A and B). The original program is quite a big program, and due to the programming structure it is difficult to read. In the

new program, we see that its clear and it is well-sequenced so it is easier to read.

In comparing their maintainability and modifiability, the new program is much easy to maintain, and easy to modify.

APPENDIX A

THE ORIGINAL PROGRAM (WRITTEN IN APPLE PASCAL)

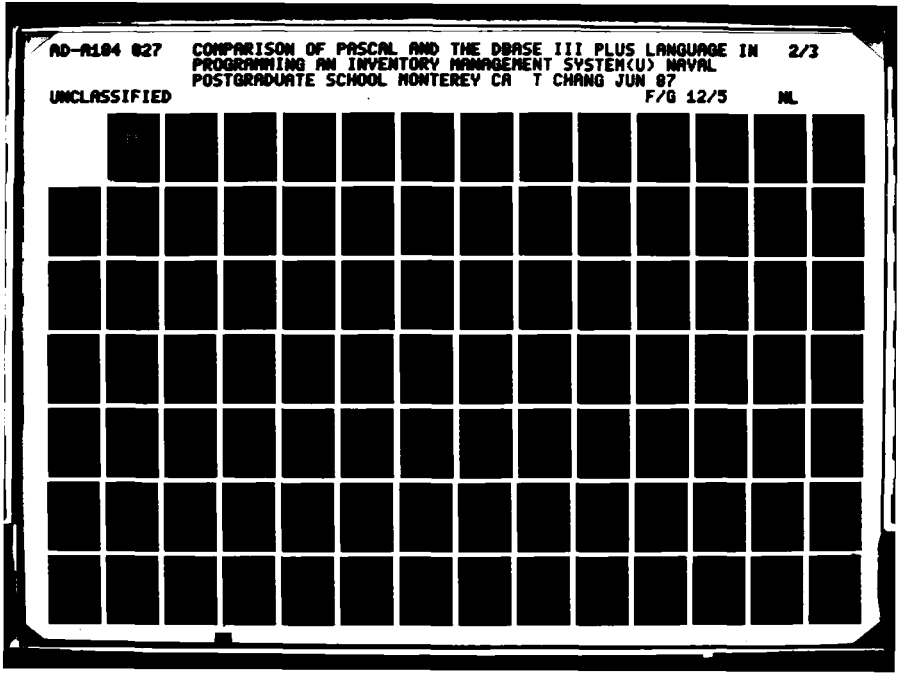
```
(*$S+*)
PROGRAM  hanaoka;
CONST ok = true;
      x  = 10;
      max = 30; (* size of hash table *)
      pmax = 30;

TYPE characters = string[80];
     numbers  = PACKED ARRAY[1..13] OF integer;
     menutype = PACKED ARRAY[0..9] OF characters,
     intype   = PACKED ARRAY[0..20] OF characters,
     datetype  = PACKED RECORD
                   month,
                   day   ,
                   year  integer;
                 END;

     statustype = (occupied,empty);

     tostype    = PACKED RECORD
                    month,wgt    integer;
                    bal,unitprice : real
                  end;

     contype   = PACKED RECORD
                    number   string[12],
                    bales    integer,
                    net : real  {integer but larger than maxint}
                  END;

     customtype = PACKED RECORD
                     name   string[25],
                     addr   string[50],
                     contrno  string[12],  * their contract no. *
                   END;

     lctype     = PACKED RECORD
                     number   string[12],
                     expdate,
                     shipdate  datetype,
                     bal,amount  real
```

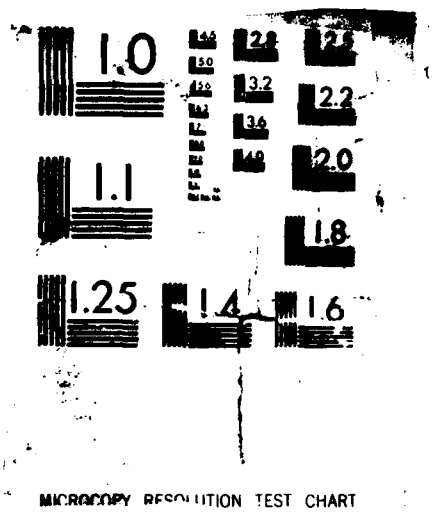
```
            END;

fsstype  =  PACKED RECORD
                status : statustype;
                number   string[12],
                contrdate : datetype;
                customer : customtype;
                commodity : string[50];
                pricebase : string[80];
                lc          : lctype;
                timeofship : ARRAY[1..7] of tostype;
                totalship, balofship   real,
                issuebank, drawbank   string[30],
                mitino     string[18],
                nofshipment,
                shipmentinfo  integer;
                              (* ptr to the shipments info *)
            END;

shiptype  = PACKED RECORD
                status   statustype,
                invoiceno   string[15],
                name, origin, dest   string[25],
                etd, invoicedate   datetype,
                totalbales   integer,
                totalnet   real,
                container   ARRAY[1  20] OF contype,
                nofcont   0  20,
                link   integer,
             END;

entry  =  PACKED RECORD
                status   statustype,
                number   string[12],
                name     string[25],
                commodity   string[
                link   integer
          END

farmertype = PACKED RECORD
                name   string[25],
                addr   string[50]
             END

trucktype =  PACKED RECORD
```

```
                    mthday : string[6];
                    wgtticketno : string[12];
                    bales : integer;
                    net,cost : real;
                  END;

    fsptype = PACKED RECORD
                    status : statustype;
                    number : string[12];
                    contrdate : datetype;
                    farmer : farmertype;
                    commodity : string[50];
                    timeofship : ARRAY[1..7] OF tostype;
                    totalship,balofship : real;
                    nofshipment,
                    shipmentinfo : integer;
                END;
    fspshiptype = PACKED RECORD
                    status : statustype;
                    truck  ARRAY[1. 20] OF trucktype;
                    noftruck : 0..20;
                    totalbales : integer;
                    totalnet,
                    payment,
                    totaltruckcost : real,
                    link  integer
                  END,

VAR fspfile          FILE OF fsptype,
    fsphashfile      FILE OF entry,
    fspshipfile      FILE OF fspshiptype,
    fspcontract      fsptype,
    fspshiprecord    fspshiptype,
    fssquerymenu, error1, error2, fssshpmenu,
    sciname, fdstfmenu, fssmenu, fspmenu,
    fspquerymenu, fspshpmenu, fspnewconmenu  menutype
    fssnewconmenu  ntype,
    choice  integer
    menu  TEXT,
    out  INTERACTIVE,
    digit  SET OF 0  9,
    continue, quit  boolean,
    fssfile  FILE OF fsstype
    fsshashfile  FILE OF entry
    fssshipfile  FILE OF shiptype
```

```
        fsscontract, fssdummy : fsstype;
        contractno : characters;
        shpamtintons, rate : real;
        fssshiprec : shiptype;

FUNCTION at(i,j:integer):char;FORWARD;
FUNCTION password:boolean;FORWARD;
FUNCTION datecheck(date:datetype):boolean;FORWARD;
FUNCTION conint(line:characters):integer;FORWARD;
FUNCTION conreal(line:characters):real;FORWARD;
FUNCTION validate(name:characters):boolean;FORWARD;
PROCEDURE addcomma(VAR line:characters);FORWARD;
PROCEDURE dollarcent(num:real;VAR twodeci:characters);
            FORWARD;
PROCEDURE prealtostr(num:real;VAR twodeci:characters);
            FORWARD;
PROCEDURE skip(n:integer);FORWARD;
PROCEDURE dateconvert(line:characters;VAR date:datetype);
            FORWARD;
PROCEDURE prompt(list:menutype;n:integer; VAR select:integer);
            FORWARD;

(*$I #5:fss1.text *)
(*$I #5:fss2.text *)
(*$I #5:fss2.5.text *)
(*$I #5:fss3.text *)
(*$I #5:fsp1.text *)
(*$I #5 fsp2.text *)

FUNCTION at,
BEGIN
  GOTOXY(i,j),
  at  = chr(0)
END,

FUNCTION validate,
VAR n
BEGIN
  max
  okset
  validate
  FOR
  BEGIN
    IF
```

```
    END;
    validate := true;
END;

FUNCTION conint;
VAR i,max,temp:integer; item:char;
BEGIN
    max := LENGTH(line); i := 0; temp := 0;
    REPEAT
        i := i + 1;
        item := line[i];
        IF item IN digit
            THEN temp := 10*temp+ord(item)-ord('0')
    UNTIL (item = '.') OR (i = max);
    conint := temp
END;

FUNCTION conreal;
VAR i,j,max : integer; temp : real; item : char;
BEGIN
    i := 1; temp := 0; max := LENGTH(line);
    line := CONCAT(line,' '); {append one blank so not to give the
                               value range error for no. with no dec pt}
    WHILE (i <= max) AND (line[i] <> '.') DO
    BEGIN
        item := line[i];
        IF item IN digit
            THEN temp := 10*temp+ord(item)-ord('0');
        i := 1 + 1
    END;
    j := 10; i := i + 1;
    (* convert the decimal places if any *)
    WHILE (i <= max) DO
    BEGIN
        item := line[i];
        IF item IN digit
            THEN temp := temp + (ord(item)-ord('0'))/j;
        j := j * 10;
        i := i + 1;
    END;
    conreal := temp
END; (* conreal *)

PROCEDURE [illegible];
VAR [illegible]
```


AD-A184 027 COMPARISON OF PASCAL AND THE DBASE III PLUS LANGUAGE IN 2/3
PROGRAMMING AN INVENTORY MANAGEMENT SYSTEM(U) NAVAL
POSTGRADUATE SCHOOL MONTEREY CA T CHANG JUN 87
UNCLASSIFIED F/G 12/5 NL



MICROCOPY RESOLUTION TEST CHART

```
BEGIN
   FOR i := 1 TO n DO
      writeln(out)
END;

PROCEDURE prealtostr;
{to change pseudo-real (i.e. integer>maxint) to string}
VAR number : ARRAY[0..9] OF string[1];
     tento    : ARRAY[0..5] OF real;
     i,j      : integer;
     temp     : real;
BEGIN
    number[0] := '0';number[1] := '1';number[2] := '2';
    number[3] := '3';number[4] := '4';number[5] := '5';
    number[6] := '6';number[7] := '7';number[8] := '8';
    number[9] := '9';
    tento[0] := 1;tento[1] := 10;tento[2] := 100;tento[3] :=1000;
    tento[4] := 10000;tento[5] := 100000.0;
    twodeci := ' ';

    FOR j := 5 DOWNTO 0 DO
    BEGIN
       temp := TRUNC(temp);
       twodeci := CONCAT(twodeci,number[i]);
       num := num - tento[j]*i
    END;

    {delete the leading zeroes}
    WHILE twodeci[1] = '0' DO
       DELETE(twodeci,1,1);
END; {prealtostr}

PROCEDURE dollarcent;
VAR whole,dec:string[6];
     number : ARRAY[0..9] OF string[1];
     tento    : ARRAY[0..5] OF real;
     i,j      : integer;
     temp     : real;
     negative: boolean;
BEGIN
    number[0] := '0';number[1] := '1';number[2] := '2';
    number[3] := '3';number[4] := '4';number[5] := '5';
    number[6] := '6';number[7] := '7';number[8] := '8';
    number[9] := '9';
    tento[0] := 1; tento[1] := 10;tento[2] := 100;tento[3] := 1000;
```

```
    tento[4] := 10000; tento[5] := 100000.0;
    whole := ' '; dec := ' ';

    IF num < 0
       THEN BEGIN
            negative := true;
            num := -1 * num;
            END
       ELSE negative := false;
    FOR j := 5 DOWNTO 0 DO
    BEGIN
      temp := num / tento[j];
      i := TRUNC(temp);
      whole := CONCAT(whole,number[i]);
      num := num - tento[j]*i
    END;
    {delete the leading zeroes}
    WHILE whole[1] = '0' DO
        DELETE(whole,1,1);
    num := TRUNC(num * 100.0 + 0.5);
    FOR j := 1 DOWNTO 0 DO
    BEGIN
       temp := num/tento[j];
       i := TRUNC(temp);
       dec := CONCAT(dec,number[i]);
       num := num - tento[j]*i;
    END;
    IF negative
      THEN twodeci := CONCAT('-',whole,'.',dec)
      ELSE twodeci := CONCAT(whole,'.',dec)
END;

PROCEDURE addcomma;
VAR i : integer;
BEGIN
  IF POS('.',line) = 0
    THEN i := 2
    ELSE i := 5;
  WHILE i < LENGTH(line) - 1 DO
  BEGIN
       INSERT(',',line,LENGTH(line) - i);
       i := i + 4;
  END
END;
```

```
PROCEDURE dateconvert;
VAR temp:datetype; max,i:integer; item :char;
BEGIN
   max := LENGTH(line);
   temp.month := 0;temp.day := 0;temp.year := 0;
   i := 1;
   WHILE line[i] <> '/' DO
   BEGIN
       item := line[i];
       temp.month := temp.month * 10 + ord(item) - ord('0');
       i := i + 1;
   END;
   i := i + 1;
   WHILE line[i] <> '/' DO
   BEGIN
      item.day := temp.day * 10 + ord(item) - ord('0');
      i := i + 1;
   END;
   i := i + 1;
   WHILE i <= max DO
       BEGIN
          item := line[i];
          temp.year := temp.year * 10 + ord(item) - ord('0');
          i := i + 1;
       END;
       date := temp
END; (* dateconvert *)

FUNCTION datecheck;
BEGIN
   IF (date.month < 1) OR (date.month > 12)
      THEN datecheck := false
   ELSE IF (date.day < 1) OR (date.day > 31)
      THEN datecheck := false
   ELSE IF (date.year < 60) OR (date.year > 99)
      THEN datecheck := false
   ELSE    datecheck := true
END; (* datecheck *)

PROCEDURE prompt;
VAR ch:char; i:integer;
BEGIN
   write(chr(12),at(15,1),list[0]);
   FOR i := 1 TO n DO
       write(at(10,2*(i+1),i,'.  ',list[i]);
```

```
    write(at(10,2*(n+2)),'Selection Please:');
    read(KEYBOARD,ch);

    WHILE (ord(ch) < ord('1')) OR (ord(ch) > n + ord('0')) DO
    BEGIN   (* range check for the selection input *)
        write(at(10,2*(n+2),'Invalid selection',chr(7),chr(7));
        write(at(10,2*(n+3),'Selection Please:');
        read(KEYBOARD,ch)
    END; (* WHILE *)
    select := ord(ch) - ord('0')    (* convert to integer *)
END; (* prompt *)

FUNCTION password;
CONST valid = 'hanaoka';
VAR cnt: integer; secret : string[7];
BEGIN
    cnt := 0;
    REPEAT
        write(chr(12),chr(7),at(10,5),'Password :');
        readln(KEYBOARD,secret);
        cnt := cnt + 1;
    UNTIL (secret = valid) OR (cnt = 3);
    IF secret <> valid
       THEN password := false
       ELSE password := true
END;  (* password *)

PROCEDURE fdstfpurchase;
VAR quit, successful : boolean;
      choice : integer;
BEGIN
    (*$I-*)
    REPEAT
       RESET(fsphashfile,'#5:fsphashfile');
       successful := (IORESULT=0);
       IF NOT successful
          THEN BEGIN
               write(chr(12),chr(7),at(0,4),'Wrong data diskette in
                     drive 2');
               write(at(5,0),'put correct one and press <RETURN>');
               readln
               END
          ELSE CLOSE(fsphashfile)
    UNTIL successful;
    (*$I+*)
```

```
    quit := false;
    REPEAT
        prompt(fspmenu,4,choice);
        CASE choice OF
        1 : fspnew;
        2 : fspshipment;
        3 : fspinquery;
        4 : quit := true
        END;
     UNTIL quit
END;  (* fdstfpurchase *)

PROCEDURE fdstfsales;
VAR quit,successful : boolean;
      choice : integer;
BEGIN
   (*$I-*)
   REPEAT
      RESET(fsshashfile,'*5:fsshashfile');
      successful := (IORESULT=0);
      IF NOT successful
         THEN BEGIN
                write(chr(12),chr(7),at(0,4),'Wrong data diskette in
                      Drive 2');
                write(at(0,5),'put correct one and press <RETURN>');
                readln
               END
         ELSE CLOSE(fsshashfile)
    UNTIL successful;
    (*$I+*)
    quit := false;
    REPEAT
       prompt(fssmenu,4,choice);
       CASE choice OF
       1 : fssnew;
       2 : fssshipment;
       3 : fssinquery;
       4 : quit := true
       END;
    UNTIL quit
END; {fdstfsales}

PROCEDURE initialize;
VAR i:integer;
BEGIN
```

```
    quit := false;
    digit := ['0','1','2','3','4','5','6','7','8','9'];
    RESET(menu,'*4:menu.text');
    FOR i := 0 TO 3 DO
        readln(menu,fdstfmenu[i]);
    FOR i := 0 TO 4 DO
        readln(menu,fssmenu[i]);
    FOR i := 0 TO 15 DO
        readln(menu,fssnewconmenu[i]);
    fspnewconmenu[1] := fssnewconmenu[1];
    fspnewconmenu[2] := fssnewconmenu[2];
    fspnewconmenu[5] := fssnewconmenu[6];
    fspnewconmenu[6] := fssnewconmenu[8];
    fspnewconmenu[3] := 'Farmer  name       :';
    fspnewconmenu[4] := 'Farmer  address    :';
    FOR i := 0 TO 3 DO
    BEGIN
      readln(menu,error1[i]);
      error2[i] := error1[i]
    END;
    error2[0] := 'Error ! No such contract exists';
    FOR i := 0 TO 5 DO
        readln(menu,fssquerymenu[i]);
    FOR i := 1 TO 6 DO
        readln(menu,fssshpmenu[i]);
    FOR i := 0 TO 3 DO
        readln(menu,sciname[i]);
    FOR i := 0 TO 4 DO
        readln(menu,fspmenu[i]);
    FOR i := 0 TO 5 DO
        readln(menu,fspquerymenu[i]);
    CLOSE(menu)
END;  (* initialize *)

BEGIN  (* main program *)
    initialize;
    IF password = ok     (* password is the boolean function *)
        THEN  REPEAT
              prompt(fdstfmenu,3,choice);
              CASE choice OF
              1 : fdstfsales;
              2 : fdstfpurchase;
              3 : quit := true
              END
            UNTIL quit
```

```
        ELSE write(at(30,25),chr(7),'Invalid password');
END.

-------------------------------------------------------------
SEGMENT PROCEDURE fssnew;
(* to add new feed stuff contract and setup the data structure
   accordingly *)
VAR  lineno,j,k,loc,choice,addr,i : integer;
       goon,finish,done,locate : boolean;
       temp : characters; ch:char;
       tempdate : datetype;

PROCEDURE tosconvert(line:characters;VAR tos:tostype);
CONST blank = ' ';
VAR temp : tostype;
     i,j,max,start : integer;
     item : characters;
BEGIN
   line := CONCAT(line,'$');
   max := LENGTH(line);
   WITH temp DO
   BEGIN
      month := 0; wgt := 0; bal := 0; unitprice := 0
   END;
   i := 1; j := 1;
   REPEAT
      WHILE (line[i] = blank) AND (i < max) DO
          i := i + 1;
      item := COPY(line,start,i-start);
      CASE j OF
      1 : temp.month := conint(item);
      2 : BEGIN
             temp.wgt := conint(item);
             temp.bal := temp.wgt
          END;
      3 : temp.unitprice := conreal(item)
      END; (* case *)
      j := j + 1
    UNTIL (j > 3) OR ( i = max);
    tos := temp
END; (* tosconvert *)

PROCEDURE getfssinfo;
(* get all the information for the new contract *)
```

```
FUNCTION  proceed : boolean;
BEGIN
   IF EOF THEN BEGIN RESET(INPUT);EXIT(fssnew) END
   ELSE IF (lineno <> 8) AND (temp = ' ')
       THEN BEGIN
              proceed := false;
              lineno := lineno - 1;
              END
   ELSE IF (lineno = 8) AND (temp = ' ')
       THEN BEGIN
              proceed := false;
              k := k - 1
              END
       ELSE proceed := true;
END;

PROCEDURE tosinfo;
BEGIN
   WITH fsscontract DO
   BEGIN
      totalship := 0;
      write(at(x,9),' 8. ',fssnewconmenu[8]);
      finish := false; k := 0;
     REPEAT
        k := k + 1;
        GOTOXY(x+33,9+k); readln(temp);
        finish := (temp = 'F') OR (temp = 'f');
        IF (proceed) AND (NOT finish)
           THEN BEGIN
                 tosconvert(temp,timeofship[k]);
                 IF(timeofship[k].month < 1) OR
                   (timeofship[k].month > 12)
                   THEN BEGIN
                         write(at(x+30,9+k),'Error in input,
                                  press <RETURN>');
                         readln;
                         write(at(x+30,9+k),' ':30);
                         k := k - 1;
                         END
                   ELSE totalship := totalship + timeofship[k].wgt
                 END;
     UNTIL (k=6) OR (finish);
     balofship := totalship;
     IF k < 6 THEN BEGIN
                   write(at(x+30,9+k),' ':30);
```

```
                    timeofship[k].month := 0
                        (* 0 is endofdate marker *)
                    END
END
END;


PROCEDURE readnextinput;
BEGIN
   WITH fsscontract DO
     CASE lineno OF
     1,3,4,5,6,7 :
          BEGIN
          write(at(x,lineno),lineno:2,'. ',fssnewconmenu[lineno]);
          readln(temp);
          IF proceed
             THEN CASE lineno OF
                    1 : number := temp;
                    3 : customer.name := temp;
                    4 : customer.contrno := temp;
                    5 : customer.addr := temp;
                    6 : commodity := temp;
                    7 : pricebase := temp;
                    END; (* case *)
           END;
      2 : BEGIN
          write(at(x,2),' 2. ',fssnewconmenu[2]);
          readln(temp);
          IF proceed
             THEN BEGIN
                    dateconvert(temp,contrdate);
                    IF datecheck(contrdate) <> ok
                       THEN BEGIN
                              write(at(38,2),'Error in input,
                                    press <RETURN>');
                              readln;
                              write(at(38,2),' ':30);
                              lineno := lineno - 1;
                              END
                    END
           END;
      8 : tosinfo;
      10,11 :
        BEGIN
          write(at(x,lineno+k+1),lineno:2,'. ',
```

```
                                        fssnewconmenu[lineno]);
            readln(temp);
            IF proceed
               THEN BEGIN
                     dateconvert(temp,tempdate);
                     IF datecheck(tempdate) <> ok
                        THEN BEGIN
                              write(at(38,line+k+1),'Error in input,
                                          press <RETURN>');
                              readln;
                              write(at(38,line+k+1),' ':30);
                              lineno := lineno - 1;
                              END
                        ELSE BEGIN
                              IF lineno = 10
                                THEN lc.expdate := tempdate
                                ELSE lc.shipdate := tempdate
                             END
                      END
      END;
     12 : BEGIN
          write(at(x,lineno+k+1),lineno:2,'. ',fssnewconmenu[lineno]);
          readln(temp);
          IF proceed THEN BEGIN
                            lc.amount := conreal(temp);
                            lc.bal := lc.amount
                          END;
          END;
     9,13,14,15 :
       BEGIN
          write(at(x,lineno+k+1),lineno:2,'. ',fssnewconmenu[lineno]);
          readln(temp);
          IF proceed
             THEN CASE lineno OF
                    9 : lc.number := temp;
                    13 : issuebank := temp;
                    14 : drawbank := temp;
                    15 : mitino := temp;
                    END
       END
    END  (* case *)
END;  (* readnextinput *)

PROCEDURE fssmodify;
(* to modify the fsscontract input information *)
```

```
BEGIN
  REPEAT
    REPEAT
      goon := true;
      write(at(55,22),'Which line to change:');
      readln(lineno); write(at(55,22),' ':24);
      IF (lineno < 1) OR (lineno > 15)
        THEN BEGIN
             write (at(55,22),chr(7),'No such line!Press <RET>');
             readln;
             write(at(55,22),' ':25);
             goon := false
             END
    UNTIL goon;
    (* now erase the line to be changed *)
    IF lineno <= 6
      THEN BEGIN
           write(at(38,lineno),' ':40);
           GOTOXY(38,lineno)
           END
    ELSE IF lineno = 7
      THEN BEGIN
           write(at(38,lineno),' ':80);
           GOTOXY(38,lineno)
           END
    ELSE IF lineno = 8
      THEN FOR j := 1 TO k DO
             write(at(43,9+j),' ':20)
             (* no GOTOXY here since it is in PROC seven *)
      ELSE BEGIN
           write(at(38,lineno+k+1),' ':40);
           GOTOXY(38,lineno+k+1)
          END;
   readnextinput;
   write(at(55,22),'Ok now?(y/n)');
   read(ch);
UNTIL (ch = 'Y') OR (ch = 'y')
END;  (* fssmodify *)


BEGIN
  write(chr(12),at(15,0),fssnewconmenu[0]);
  lineno := 1;
  REPEAT
    readnextinput;
```

```
      lineno := lineno + 1;
    UNTIL  lineno > 15;
fsscontract.nofshipment := 0; fsscontract.status := occupied;
write(at(55,22),'Input OK?(y/n)');
read(ch); IF (ch = 'N') OR (ch = 'n') THEN fssmodify
END; (* getfssinfo *)


BEGIN   (* fssnew *)
  getfssinfo;(*input all pertinent new sales contract info *)
  (* go thru the file and make sure that the given contract # is
     not already in the file *)
  RESET(fsshashfile,'#5:fsshashfile');
  REPEAT
     done := true;
     i := -1;
     REPEAT
        i := i + 1;
        SEEK(fsshashfile,i);
        GET(fsshashfile)
     UNTIL (EOF(fsshashfile)) OR
               (fsshashfile^.number = fsscontract.number);
     IF fsshashfile^.number = fsscontract.number
      THEN REPEAT  (* error! same contract already in table *)
             prompt(error1,3,choice);
             CASE choice OF
             1 : BEGIN CLOSE(fsshashfile);EXIT(fssnew) END;
             2 : BEGIN CLOSE(fsshashfile);fssinquery    END;
             3 : BEGIN
                 REPEAT
                   write(chr(12),at(x,3),'Contract number
                                    (<ctrl-c> to quit):');
                   readln(fsscontract.number);
                 UNTIL (fsscontract.number <> ' ') OR EOF;
                 done := false;
                 IF EOF THEN BEGIN
                             CLOSE(fsshashfile);
                             RESET(INPUT);
                             EXIT(fssnew)
                             END
                 END;
               END; (* case *)
           UNTIL  choice = 3
    (* no error so put into the fssfile and fsshashfile *)
    ELSE BEGIN
```

```
      (* place the new sales contract info into the fssfile;
         place at the first open slot *)
      RESET(fssfile,'*5:fssfile');
      (* put the contract info into the first open slot *)
      loc := -1;
      REPEAT
         loc := loc + 1;
         SEEK(fssfile,loc);
         GET(fssfile);
      UNTIL (fssfile^.status = empty) OR (EOF(fssfile));
      IF EOF(fssfile)
        THEN BEGIN
             write(chr(12),at(x,3),'DOOMESDAY!No more space',
                        ' to add new contract');
             write(at(x,4),'Must use new diskette. Press<RET>');
             readln; CLOSE(fssfile); EXIT(fssnew)
             END;
      fssfile^ := fsscontract;
      SEEK (fssfile,loc);
      PUT(fssfile); CLOSE(fssfile);
      write(at(0,22),'loc = ',loc);

      (* find open slot in fsshashfile *)
      RESET(fsshashfile);
      i := -1;
      REPEAT
          i := i + 1;
          SEEK(fsshashfile,i);
          GET(fsshashfile);
      UNTIL fsshashfile^.status = empty;

      (* put in the information *)
      WITH fsshashfile^ DO
      BEGIN
         status := occupied;
         number := fsscontract.number;
         name := fsscontract.customer.name;
         link := loc;
         commodity := fsscontract.commodity
      END;
      SEEK(fsshashfile,i);
      PUT(fsshashfile);
      CLOSE(fsshashfile)
      END
UNTIL done
```

```
END; (* fssnew *)
-----------------------------------------------------------
SEGMENT PROCEDURE fssshipment;
VAR  choice,loc,sfloc,i,j,m,old : integer;
     done,bankpay,lastship : boolean;
     inp : string[10];
     bankpayamt : real;
     ch : char;

PROCEDURE computepart;
BEGIN
WITH fsscontract DO
BEGIN
  i := 1;  (8 find out which months *)
  write(chr(12),at(18,0),'month      @price');
  REPEAT
    write(at(20,i),timeofship[i].month:2,'      $',
          timeofship[i].unitprice:7:2);
    IF timeofship[i].month = fssshiprec.invoicedate.month
      THEN BEGIN
             m := i;
             rate := timeofship[i].unitprice
             END;
    i ;= i + 1;
  UNTIL (i > 6) OR (timeofship[i].month = 0);

  write(at(20,i+2),'Compute the price with the above rate?(y/n)');
  read(ch);
  IF ch IN ['N','n']
     THEN REPEAT
            write(at(20,10),'Rate = ');
            readln(inp);IF inp <> ' ' THEN rate := conreal(inp)
          UNTIL inp <> ' '
  ELSE IF i > 6
     THEN REPEAT
            write(at(30,i+3),'But you must give me the rate');
            write(at(20,10),'Rate = ');
            readln(inp);IF inp <> ' ' THEN rate := conreal(inp)
          UNTIL inp <> ' ';

  shpamtintons := fssshiprec.totalnet / 2000;
  timeofship[m].bal := timeofship[m].bal - shpamtintons;
  balofship := balofship - shpamtintons;
  IF (timeofship[m].bal < 0) AND (timeofship[m+1].month <>0)
    THEN timeofship[m+1].bal := timeofship[m+1].bal
```

```
                        + timeofship[m].bal;
    IF balofship < 0
       THEN lastship := true;
    lc.bal := lc.bal - shpamtintons * rate;
    IF lc.bal < 0
      THEN BEGIN
           bankpay := true;
           bankpayamt := -lc.bal
           END;
    IF nofshipment <> 0
      THEN BEGIN                    (* more than one shipments so *)
           i := 0;j := shipmentinfo;(* link up the shipment records*)
           RESET(fssshipfile,'#5:fssshipfile');
           REPEAT
             SEEK(fssshipfile,j); old := j;
             GET(fssshipfile);
             j := fssshipfile^.link;
             i := i + 1;
           UNTIL i = nofshipment;
           fssshipfile^.link := sfloc;
           SEEK(fssshipfile,old); PUT(fssshipfile);
           CLOSE(fssshipfile); (* put back into the original place *)
           END
      ELSE shipmentinfo := sfloc; (* first shipment *)
    nofshipment := nofshipment + 1;
  END; (* with *)
  END; (* computepart *)

  BEGIN (* fssshipment *)
    RESET(fsshashfile,'#5:fsshashfile');
    REPEAT (* till the correct contract no given *)
      done := true;
      REPEAT
        write(chr(12),at(x,3),'Contract number: ');
        readln(contractno)
    UNTIL (contractno <> ' ') OR EOF;
    IF EOF THEN BEGIN RESET(INPUT);
                      CLOSE(fsshashfile);EXIT(fssshipment) END;
    i := -1;
    REPEAT
       i := i + 1;
       SEEK(fsshashfile,i);
       GET(fsshashfile)
    UNTIL (EOF(fsshashfile) OR (fsshashfile^.number = contractno);
    IF EOF(fsshashfile)
```

```
    THEN REPEAT
           prompt(error2,3,choice);
           CASE choice OF
           1 : BEGIN CLOSE(fsshashfile);EXIT(fssshipment) END;
           2 : BEGIN CLOSE(fsshashfile);fssinquery END;
           3 : done := false
           END;
           UNTIL  choice = 3
    ELSE  BEGIN  (* ok find the contract info from fssfile *)
           loc := fsshashfile^.link; CLOSE(fsshashfile);
           RESET(fssfile,'#5:fssfile');
           SEEK(fssfile,loc);
           GET(fssfile); fsscontract := fssfile^;
           CLOSE(fssfile)
           END;
UNTIL done;

getshipinfo;
 (* put this info into the fssshipfile *)
bankpay := false; lastship := false;
RESET(fssshipfile,'#5:fssshipfile'); sfloc := -1;
REPEAT
     sfloc := sfloc + 1;
     SEEK(fssshipfile,sfloc);
     GET(fssshipfile)
UNTIL (EOF(fssshipfile)) OR (fssshipfile^.status = empty);
write(at(0,22),'sfloc = ',sfloc);

IF EOF(fssshipfile)
   THEN BEGIN
          CLOSE(fssshipfile);
          write(chr(12),chr(7),at(x,2),
             'DOOMESDAY no more space in the file');
          write(at(x,3),'Please call the system designer');
          write(at(x,4),'Meantime press <RETURN> and
                                 do other work');
          readln; EXIT(fssshipment)
          END;
fssshipfile^ := fssshiprec;
SEEK(fssshipfile,sfloc);
PUT(fssshipfile); CLOSE(fssshipfile);

(* make the necessary computation and save it *)
computepart;
(* now put it into the fssfile *)
```

```
    RESET(fssfile,'#5:fssfile');
    fssfile^ := fsscontract;
    SEEK(fssfile,loc); PUT(fssfile);
    CLOSE(fssfile);

    shippaperwork
    END;  (* fssshipment *)
SEGMENT PROCEDURE listtoscreen;
VAR k : integer;  twodeci : characters;

PROCEDURE listtop; (* half of contract information *)
BEGIN
    WITH fsscontract DO
    BEGIN
      write(chr(12),at(15,0),'Feed Stuff Sales Contract Information');
      write(at(x,1),fssnewconmenu[1],' ',number);
      write(at(x,2),fssnewconmenu[2],' ',contrdate.month,'/',
                contrdate.day,'/',contrdate.year);
      write(at(x,3),fssnewconmenu[3],' ',customer.name);
      write(at(x,4),fssnewconmenu[4],' ',customer.contrno);
      write(at(x,5),fssnewconmenu[5],' ',customer.addr);
      write(at(x,6),fssnewconmenu[6],' ',commodity);
      write(at(x,7),fssnewconmenu[7],' ',pricebase);
    END;
END;  (* listtop *)

PROCEDURE listbottom;
(* bottom half of fsscontract info *)
BEGIN
    WITH fsscontract DO
    BEGIN
    k := 1;
    write(at(x,9),
    'Time of shipment    :  Months  Quantity  Balance  Unitprice');
    REPEAT
      write(at(29+x,9+x),timeofship[k].month:2,timeofship[k].wgt:10,
            timeofship[k].bal:12:2,'    $',timeofship[k].unitprice:8:2);
      k := k + 1
    UNTIL (timeofship[k].month = 0) OR (k > 6);
    write(at(x, 9+k),'total shipment          : ',totalship:8:2);
    write(at(x,10+k),'balance of shipment  : ',balofship:8:2);
    write(at(0,22),'Press <RETURN>'); readln;
    write(at(x,2),fssnewconmenu[10],' ',lc.expdate.month,'/',
          lc.expdate.day,'/',lc.expdate.year);
    write(at(x,3),fssnewconmenu[11],' ',lc.shipdate.month,'/',
```

```
        lc.shipdate.day,'/',lc.shipdate.year);
   dollarcent(lc.amount,twodeci);addcomma(twodeci);
   write(at(x,4),fssnewconmenu[12],' $',twodeci:10);
   dollarcent(lc.bal,twodeci);addcomma(twodeci);
   write(at(x,5),'L/C balance              : $',twodeci:10);
   write(at(x,6),fssnewconmenu[13],issuebank);
   write(at(x,7),fssnewconmenu[14],drawbank);
   write(at(x,8),faanewconmenu[15],' ',mitino);
   write(at(x,9),'# of shipment made  : ',nofshipment);
 END; (* with *)
END; (* listbottom *)

BEGIN  {listtoscreen}
   listtop;
   listbottom
END;


SEGMENT PROCEDURE listtoprinter;
VAR i,k : integer; str1,str2,twodeci : characters;

PROCEDURE prlisttop; (* half of contract info to printer *)
BEGIN
   WITH fsscontract DO
   BEGIN
      skip(4);
      writeln(out,' ':20,'Feed Stuff Sales Contract Information');
      skip(3);
      writeln(out,' ':10,fssnewconmenu[1],' ',number);writeln(out);
      writeln(out,' ':10,fssnewconmenu[2],' ',contrdate.month,'/',
            contrdate.day,'/',contrdate.year);writeln(out);
      writeln(out,' ':10,fssnewconmenu[3],' ',customer.name);
      writeln(out);
      writeln(out,' ':10,fssnewconmenu[4],' ',customer.contrno);
      writeln(out);
      writeln(out,' ':10,fssnewconmenu[5],' ',customer.addr);
      writeln(out);
      writeln(out,' ':10,fssnewconmenu[6],' ',commodity);
      writeln(out);
      IF LENGTH(pricebase) < 41
        THEN writeln(out,' ':10,fssnewconmenu[7],' ',pricebase)
        ELSE BEGIN
             i := 41;
             REPEAT
               i := i - 1
```

```
            UNTIL pricebase[i] = ' ';
            str1 := COPY(pricebase,1,i-1);
            str2 := COPY(pricebase,i+1,LENGTH(pricebase)-i);
            writeln(out,' ':10,fssnewconmenu[7],' ',str1);
            writeln(out,' ':35,str2)
            END;
   END;
END;  (* prlisttop *)

PROCEDURE prlistbottom;
(* bottom half of fsscontract info to the printer *)
BEGIN
   WITH fsscontract DO
   BEGIN
   skip(2); k := 1;
   writeln(out,' ':10,
   'Time of shipment      :  Months Quantity  Balance  Unitprice');
   REPEAT
      writeln(out,' ':39,timeofship[k].month:2,timeofship[k].wgt:10,
           timeofship[k].bal:12:2,'  $',timsofship[k].unitprice:8:2);
      k := k + 1;
   UNTIL (timeofship[k].month = 0) OR (k > 6); skip(2);
   writeln(out,' ':10,'total shipment          : ',totalship:8:2);
   writeln(out);
   writeln(out,' ':10,'balance of shipment : ',balofship:8:2);
   writeln(out);
   writeln(out,' ':10,fssnewconmenu[9],' ',lc.number);writeln(out);
   writeln(out,' ':10,fssnewconmenu[10],' ',lc.expdate.month,'/',
           lc.expdate.day,'/',lc.expdate.year); writeln(out);
   writeln(out,' ':10,fssnewconmenu[11],' ',lc.shipdate.month,'/',
           lc.shipdate.day,'/',lc.shipdate.year); writeln(out);
   dollarcent(lc.amount,twodeci);addcomma(twodeci);
   writeln(out,' ':10,fssnewconmenu[12],' $',twodeci:10);
   writeln(out);
   dollarcent(lc.bal,twodeci); addcomma(twodeci);
   writeln(out,' ':10,'L/C balance              :$ ', twodeci:10);
   writeln(out);
   writeln(out,' ':10,fssnewconmenu[13],' ',issuebank);writeln(out);
   writeln(out,' ':10,fssnewconmenu[14],' ',drawbank);writeln(out);
   writeln(out,' ':10,fssnewconmenu[15],' ',mitino);writeln(out);
   writeln(out,' ':10,'# of shipment made   : ',nofshipment);
END;  (* with *)
END;  (* prlistbottom *)

BEGIN    {listtoprinter}
```

```
   prlisttop;
   prlistbottom
END;

SEGMENT PROCEDURE fssresiduecheck;
VAR j,opencnt : integer;
BEGIN
   write(chr(12),at(x,2),'Available Space'); opencnt := 0;
    j := 0;  RESET(fssfile,'#5:fssfile');
   SEEK(fssfile);
   GET(fssfile);
   write(at(x,4),'Contract file: ');
   WHILE NOT EOF(fssfile) DO
   BEGIN
      IF fssfile^.status = empty
         THEN BEGIN
                opencnt := opencnt + 1;
                write(at(x+19,4),opencnt:3)
                END;
      j := j + 1;
      SEEK(fssfile,j);
      GET(fssfile)
   END;
   CLOSE(fssfile);
   opencnt := 0; j := 0;
   write(at(x,5),'Shipment file: ');
   RESET(fssshipfile,'#5:fssshipfile');
   SEEK(fssshipfile,j); GET(fssshipfile);
   WHILE NOT EOF(fssshipfile) DO
   BEGIN
      IF fssshipfile^.status = empty
        THEN BEGIN
               opencnt ;= opencnt + 1;
               write(at(x+19,5),opencnt:3)
               END;
      j := j + 1;
      SEEK(fssshipfile,j);
      GET(fssshipfile)
    END;
    CLOSE(fssshipfile);
    write(at(0,7),'Press <RETURN>'); readln
END;   {fssresiduecheck}


SEGMENT PROCEDURE fssinquery;
```

```
VAR i,j,k,num,entries,loc : integer;
    compname : string[25];
    quit : boolean;
    customlist : intype; ch : char; twodeci,str1,str2:characters;

PROCEDURE listship;
VAR sumbales, sumnet ; real;
BEGIN
  WITH fssshiprec DO
  BEGIN
    write(chr(12),at(0,0),'Shipname : ',name);
    write(at(38,0),'inv date:',invoicedate.month,'/',
          invoicedate.day,'/',invoicedate.year);
    write(at(60,0),'etd:',etd.month,'/',etd.day,'/',etd.year);
    write(at(0,1),'origin port:',origin);
    write(at(38,1),'destination port:',dest);
    write(at(18,2),'Container#',at(33,2),'Bales',at(41,2),'Net wgt');
    sumbales := 0; sumnet := 0;
    FOR k := 1 TO nofcont DO
      WITH container[k] DO
      BEGIN
        sumbales := sumbales + bales;
        sumnet   := sumnet + net;
        prealtostr(net,twodeci);addcomma(twodeci0;
        write(at(18,3+k),number,at(31,3+k),bales:5,at(40,3+k),
              twodeci:7)
      END;
     prealtostr(sumbales,str1);addcomma(str1);
     prealtostr(sumnet,str2);addcomma(str2);
     writeln(at(31,nofcont+4),'-----',at(40,nofcont+4),'-------');
     writeln(at(26,nofcont+5),str1:10,str2:11);
  END
END;


PROCEDURE prlistship;
VAR sumbales,sumnet : real;
BEGIN
WITH fssshiprec DO
BEGIN
  write(at(0,20),' ':70);
  write(at(0,22),'Need a printout?(y/n)');
  read(ch); IF EOF THEN BEGIN RESET(INPUT);EXIT(prlistship) END;
  IF ch IN ['Y','y']
    THEN BEGIN
```

```
            write(at(0,22),'Turn on the TEC and press <RETURN>');
            readln;
            REWRITE(out,'PRINTER:');skip(4);
            writeln(out,'   Shipment No.',num,
             '          Invoice  No.',fssshiprec.invoiceno);writeln(out);
            writeln(out,'    shipname: ',name);skip(2);
            writeln(out,'    invoice date: ',invoicedate.month,'/',
                invoicedate.day,'/',invoicedate.year);writeln(out);
            writeln(out,'     etd    :',etd.month,'/',etd.day,'/',
                  etd.year);skip(3);
            writeln(out,' ':18,Container #',' ':5,'Bales',' ':5,
                      'Net wgt');skip(2);
            sumbales := 0;  sumnet := 0;
            FOR k := 1 TO nofcont DO
               WITH container[k] DO
               BEGIN
                  sumbales := sumbales + bales;
                  sumnet := sumnet + net;
                  prealtostr(net,twodeci);addcomma(twodeci);
                  writeln(out,' ':18,number:12,' ':5,bales:5,' ':5,
                            twodeci:7);
                  writeln(out);
               END;
            prealtostr(sumbales,str1);addcomma(str1);
            prealtostr(sumnet,str2);  addcomma(str2);
            writeln(out,' ':35,'-----',' ':5,'-------');
            writeln(out,' ':30,str1:10,str2:12);
           CLOSE(out)
           END
   END; (* with *)
END;

PROCEDURE onecontrinfo;

PROCEDURE case3sub;
BEGIN
   write(at(0,22),'Need a printout?(y/n)');read(ch);
   IF EOF THEN BEGIN RESET(INPUT);EXIT(case3sub)  END;
   IF ch IN ['Y','y']
     THEN BEGIN
           write(at(0,22),'Turn on the TEC and press <RETURN>');
           readln; REWRITE(out,'printer:');
           listtoprinter; CLOSE (out)
           END;
   IF fsscontract.nofshipment > 0 THEN
```

```
BEGIN
write(at(0,22),
   'Like to see all shipments in sequence?(y/n/<ctrl-c> to quit)');
read(ch);IF EOF THEN BEGIN RESET(INPUT);EXIT(case3sub) END;
IF ch IN ['Y','y']
  THEN BEGIN
        i := 0; j := fsscontract.shipmentinfo;
        RESET(fssshipfile,'#5:fssshipfile');
        REPEAT
           SEEK(fssshipfile);
           GET(fssshipfile);
           j := fssshipfile^.link; i := i + 1; num := i;
           fssshiprec := fssshipfile^;
           listship;prlistship;
           IF i < fsscontract.nofshipment
              THEN BEGIN
                   write(at(0,22),
                   'Want to see next shipment?(y/n)  ');
                   read(ch);write(at(0,22),' ':50);
                   IF EOF THEN BEGIN CLOSE(fssshipfile);
                   RESET(INPUT);EXIT(case3sub) END
                   END
        UNTIL (i = fsscontract.nofshipment) OR (ch IN
                                        ['N','n']);
        CLOSE(fssshipfile);
        END
   ELSE BEGIN
        REPEAT
          write(at(0,22),' ':50);     (* erase previous line *)
          REPEAT
            write(at(0,22),'Which shipment(<ctrl-c> to quit):');
            readln(num); IF EOF THEN BEGIN RESET(INPUT);
            EXIT(case3sub) END
          UNTIL (num >= 1) AND
                     (num<=fsscontract.nofshiopment);
            (* locate the shipment info *)
            i := 0; j := fsscontract.shipmentinfo;
            RESET(fssshipfile,'#5:fssshipfile');
            REPEAT
               SEEK(fssshipfile,j);
               GET(fssshipfile);
               j := fssshipfile^.link; i := i + 1;
            UNTIL i = num;
            fssshiprec := fssshipfile^; CLOSE(fssshipfile);
            listship; prlistship;
```

```
                write(at(0,22),'Like to see another shipment?(y/n)');
                 read(ch);IF EOF THEN BEGIN RESET(INPUT);
                 EXIT(case3sub) END
              UNTIL  ch IN ['N','n']
              END  (* else *)
    END
END;   (* case3sub *)

BEGIN  (* onecontrinfo *)
   REPEAT
     write(chr(12),at(x,3),'Contract number:');
     readln(contractno);
   UNTIL (contractno <> ' ') OR EOF; (* not empty or terminate *)
   IF EOF THEN BEGIN RESET(INPUT);EXIT(fssinquery) END;
   RESET(fsshashfile,'#5:fsshashfile'); i := -1;
   REPEAT
     i := i + 1;
     SEEK(fsshashfile,i);
     GET(fsshashfile)
   UNTIL (EOF(fsshashfile)) OR (fsshashfile^.number=contractno);
   IF EOF(fsshashfile)  (* not found *)
     THEN BEGIN
           CLOSE(fsshashfile);
           write(at(x,5),chr(7),'No such contract in the file');
           write(at(x,7),'Press <RETURN>'); readln;
           END
     ELSE BEGIN
          CLOSE(fsshashfile);
          loc := fsshashfile^.link;
          RESET(fssfile,'#5:fssfile');
          SEEK(fssfile,loc);GET(fssfile);CLOSE(fssfile);
          fsscontract := fssfile^;
          listtoscreen;
          case3sub
          END;
END;

BEGIN  (* fssinquery *)
   quit := false;
   REPEAT
     prompt(fssquerymenu,5,choice);
     CASE choice OF
     1 : BEGIN
           RESET(fsshashfile,'#5:fsshashfile');
           write(chr(12),at(15,0),'List of all customer');
```

```
    entries := 1; customlist[1] := ' '; j := -1;
    REPEAT
      REPEAT
         j := j + 1;
         SEEK(fsshashfile,j);
         GET(fsshashfile)
      UNTIL(EOF(fsshashfile)) OR
                        (fsshashfile^.status <> empty);
      IF NOT EOF(fsshashfile)
        THEN BEGIN
              i := 1;
              (* check if this record's name is already in
                 customers array, if not put it *)
              while (i<entries) AND (fsshashfile^.name
                                  <> customlist[i]) DO
                   i := i + 1;
              IF i = entries
              (* not in customers array so put it in *)
                THEN BEGIN
                      customlist[i] := fsshashfile^.name;
                      entries := entries + 1
                      END;
              END
      UNTIL EOF(fsshashfile);
      CLOSE(fsshashfile); i := 1;
      WHILE i <= entries - 1 DO
      BEGIN
        IF validate(customlist[i])
          THEN write(at(x,i),customlist[i]);
        i := i + 1
      END;
      write(at(55,22),'Press <RETURN>');readln
    END;
2 : BEGIN
      REPEAT
        write(chr(12),at(x,3),'Company name:');
        readln(compname)
      UNTIL (compname <> ' ') OR EOF;
      (*not empty or terminate *)
      IF EOF THEN BEGIN RESET(INPUT);EXIT(fssinquery)
                  END;
      RESET (fsshashfile,'#5:fsshashfile');
      write(chr(12),at(15,0),'Contract with ',compname);
      j := 2;
      FOR i := 0 TO max DO
```

```
                BEGIN
                   SEEK(fsshashfile,i);
                   GET(fsshashfile);
                   IF (fsshashfile^.name = occupied)
                       AND (fsshashfile^.name = compname)
                     THEN BEGIN
                          write(at(x,j),fsshashfile^.number,'       ',
                                fsshashfile^.commodity);
                          j := j + 1;
                          END;
                   IF j = 22 (* full screen *)
                     THEN BEGIN
                          write(at(55,22),'Press <RETURN>');
                          readln;write(chr(12)); j := 2
                          END;
                END;
                write(at(55,22),'Press <RETURN>');readln;
                CLOSE(fsshashfile)
             END;
        3 :  onecontrinfo;
        4 :  fssresiduecheck;
        5 :  quit := true;
        END; (* case *)
     UNTIL quit
END;
-------------------------------------------------------------
SEGMENT PROCEDURE getshipinfo;
VAR k,lineno,xaxis : integer;
      ch : char;
      finish,goon : boolean;
      temp : characters;
      tempdate : datetype;

PROCEDURE contconvert(line:characters;VAR cont:contype);
CONST blank = ' ';
VAR temp : contype;
      i,j,max,start : integer;
      gross,tare : real;
      item : characters;
BEGIN
   line := CONCAT(line,'$');
   WITH temp DO
   BEGIN
      number := blank; net := 0; bales := 0;
   END;
```

```
    temp.number := COPY(line,1,12);
    DELETE(line,1,12);
    i := 1; j := 1; max := LENGTH(line);
    REPEAT
      WHILE (line[i] = blank) AND (i<max) DO
        i := i + 1;
      start := i;
      WHILE (line[i] <> blank) AND (i < max) DO
        i := i + 1;
      item := COPY(line,start,i-start);
      CASE j OF
      1 : temp.bales := conint(item);
      2 : gross      := conreal(item);
      3 : BEGIN
          tare := conreal(item);
          temp.net := gross - tare
          END
      END; (* case *)
      j := j + 1
    UNTIL (j > 3) OR (i = max);
    cont := temp
END;

FUNCTION sproceed : boolean;
BEGIN
    IF EOF THEN BEGIN RESET(INPUT);EXIT(getshipinfo) END
    ELSE IF temp = ' '
        THEN BEGIN
              sproceed := false;
              lineno := lineno -1
              END
        ELSE sproceed := true
END;

PROCEDURE nextshipinput;
BEGIN
    WITH fssshiprec DO
    BEGIN
    CASE lineno OF
    1 : BEGIN
          write(at(0,0),'1.',fssshpmenu[1]);
          readln(temp);
          IF sproceed THEN name := temp
        END;
 2,3 : BEGIN
```

```
        IF lineno = 2 THEN xaxis := 38 ELSE xaxis := 60;
        write(at(xaxis,0),lineno,'.',fssshpmenu[lineno]);
        readln(temp);
        IF sproceed
          THEN BEGIN
                dateconvert(temp,tempdate);
                IF datecheck(tempdate) <> ok
                  THEN BEGIN
                        write(at(xaxis,0),'Error,press <RETURN>');
                        readln;
                        write(at(xaxis,0),' ':20);
                        lineno := lineno - 1
                        END
                ELSE IF lineno = 2
                   THEN invoicedate := tempdate
                   ELSE etd := tempdate
                END
      END;
4,5 : BEGIN
        IF lineno = 4 THEN xaxis := 0 ELSE xaxis := 38;
        write(at(xaxis,1),lineno,'.',fssshomenu[lineno]);
        readln(temp);
        IF sproceed
          THEN IF lineno = 4
                  THEN origin := temp
                  ELSE dest := temp
      END;
END; (* case *)
IF (lineno >= 6)
  THEN BEGIN
        write(at(0,2),' ',fssshpmenu[6]);
        write(at(14,lineno-3),lineno:2,'. ');
        readln(temp);
        finish := (temp = 'F') OR (temp = 'f');
        IF (sproceed) AND (NOT finish)
          THEN BEGIN
                contconvert(temp,container[lineno-5]);
                write(at(56,lineno-3),container[lineno-5].net:8:1);
                totalbales := totalbales+container[lineno-5].bales;
                totalnet   := totalnet+container[lineno-5].net;
                IF lineno-5 > nofcont THEN nofcont := lineno-5
                {necessary not to reset nofcont when called from
                                                shipmodify}
                END;
        IF finish
```

```
          THEN write(at(14,lineno-3),' ':60)
        END  {if}
    END  {with}
END;  (* nextshipinput *)

PROCEDURE shipmodify;
BEGIN
  REPEAT
    REPEAT
      goon := true;
      write(at(55,22),'Which line to change:');
      readln(lineno);write(at(55,22),' ':24);
      IF (lineno < 1) OR (lineno > fssshiprec.nofcont + 5)
        THEN BEGIN
             write(at(55,22),chr(7),'No such line,
                                    press <RETURN>');
             readln;write(at(55,22),' ':25); goon := false
             END
    UNTIL goon;
    (* now erase the line to be changed *)
    IF lineno <= 5
      THEN CASE lineno OF
             1 : write(at(11,0),' ':25);
             2 : write(at(49,0),' ':11);
             3 : write(at(66,0),' ':12);
             4 : write(at(14,1),' ':24);
             5 : write(at(57,1),' ':23);
             END   (* case *)
      ELSE WITH fssshiprec DO
             BEGIN
             write(at(18,lineno-3),' ':60);
             totalbales := totalbales - container[lineno-5].bales;
             totalnet := totalnet - container[lineno-5].net
             END;
    (* read the modifying line *)
    nextshipinput;
    write(at(55,22),'Ok now?(y/n)'); read(ch)
  UNTIL ch IN ['Y','y']
END;  (* shipmodify *)

BEGIN  (* getshipinfo *)
  lineno := 1;fssshiprec.totalbales := 0;
  fssshiprec.totalnet := 0;fssshiprec.nofcont := 0;
  REPEAT   { get the invoice number }
    write(chr(12),at(x,3),'Invoice number(append):',
```

```
                                        fsscontract.number);
      readln(fssshiprec.invoiceno);
      fssshiprec.invoiceno:=CONCAT(fsscontract.number,
                                        fssshiprec.invoiceno);
      write(at(x,5),'Invoice no. will be ',fssshiprec.invoiceno);
      write(at(x,6),'Correct?(y/n)');
      read(ch)
   UNTIL ch IN ['Y','y']; writeln(chr(12)); finish := false;
   REPEAT
      nextshipinput;
      lineno := lineno + 1
   UNTIL (lineno > 25) OR (finish);
   fssshiprec.status := occupied;
   write(at(55,22),'Input OK?(y/n)'); read(ch);
   IF ch IN ['N','n'] THEN shipmodify
END;

-------------------------------------------------------------

SEGMENT PROCEDURE shippaperwork;
VAR calendar : ARRAY[1..12] OF string[9];
      format1,format2,format3,firsthalf,sechalf:characters;
      k,choice,i,oneline,casecnt : integer;
      ch : char;

PROCEDURE signature;
BEGIN
   skip(3);
   writeln(out,' ':20,'KOBE    MERCHANTILE , INC');writeln(out);
   writeln(out,' ':20,'signed _____');
   writeln(out,' ':20,'S.HANAOKA,General Manager');
END;

PROCEDURE underline(i,j : integer);
BEGIN
   write(out,' ':i);
   FOR i := 1 TO j DO
      write(out,'-');
   writeln(out)
END;

PROCEDURE  ashipinv;
BEGIN
   WITH fsscontract,fssshiprec DO
   BEGIN
```

```
      skip(8);
      writeln(out,' ':65,calendar[invoicedate.month],' ',
        invoicedate.day,',19',invoicedate.year);writeln(out);
      writeln(out,' ':7,invoiceno,' ':24-LENGTH(invoiceno),
              shpamtintons:7:3,' shorttons of',commodity);
      writeln(out);
      writeln(out,' ':43,name);writeln(out);
      writeln(out,' ':25,calendar[etd.month],' ',etd.day,',19',
                        etd.year); writeln(out);
      writeln(out,' ':9,origin,' ':36-LENGTH(origin),dest);
      writeln(out);
      writeln(out,' ':26,customer.name);writeln(out);
      writeln(out,' ':8,customer.addr);writeln(out);
      writeln(out,' ':19,customer.contrno,
                ' ':41-LENGTH(customer.contrno),lc.number);
      writeln(out);
      writeln(out,' ':19,number,' ':41-LENGTH(number),mitino);
      skip(5);
      writeln(out,' ':18,commodity);
    END
END;

PROCEDURE bshipinv;
BEGIN
  WITH fssshiprec,fscontract DO
  BEGIN
    format2 := pricebase;
    WHILE LENGTH(format2) > 31 DO
    { write pricebase using 2 or 3 lines }
    BEGIN
      i := 31;
      REPEAT  i := i + 1  UNTIL format2[i] = ' ';
      format1 := COPY(format2,1,i-1);
      format2 := COPY(format2,i+1,LENGTH(format2)-i);
      writeln(out,' ':51,format1)
    END;
    writeln(out,' ':51,format2);
    writeln(out,' ':17,'Container#    Bales    Net wgt(lbs)');
    writeln(out,' ':17,'----------    -----    ------------');
    FOR k := 1 TO nofcont DO
    WITH container[k] DO
    BEGIN
      prealtostr(net,format1);addcomma(format1);
      writeln(out,' ':17,number,' ':14-LENGTH(number),bales:4,
                ' ':3,format1:10)
```

```
    END;
    writeln(out,' ':17,'_____');
    writeln(out,' ':3,nofcont,' X 40 foot');
    writeln(out,' ':3,'CONTAINERS');
    prealtostr(totalnet,format1);addcomma(format10;
    dollarcent(shpamtintons*rate,format2);addcomma(format2);
    STR(totalbales,format3);addcomma(format3);
    writeln(out,' ':17,'Total',format3:6,' Bales ',format1:10,
                        ' lbs');
    writeln(out,' ':17,format1:9,'  lbs=',shpamtintons:7:3,
          '  shorttons','  @US',rate:8:2,' US$',format2:10);
    writeln(out,' ':17,'==================================',
                ' ':14,'==============='); signature
  END
END;

PROCEDURE ashippaklist;
BEGIN
  WITH fsscontract,fssshiprec DO
  BEGIN
    skip(9);
    writeln(out,' ':30,'P A C K I N G    L I S T ');
    writeln(out,' ':30,'----------------------'); skip(2);
    underline(3,74);
    writeln(out,' ':3,'INVOICE NO: ',invoiceno,
          ' ':29-LENGTH(invoiceno),'DATE: ',
          calendar[invoicedate.month],' ',invoicedate.day,
          ',19',invoicedate.year);underline(4,72);
    writeln(out,' ':3,'MESSRS: ',customer.name);
    writeln(out,' ':11,customer.addr);skip(2);underline(4,72);
    writeln(out,' ':3,'SHIPPED PER: ',name,' ':28-LENGTH(name),
          'SAILING ON/OR ABOUT: 'calendar[etd.month],' ',
          etd.day,',19',etd.year);underline(3,74);
    writeln(out,' ':3,'FROM:',origin,' ':35-LENGTH(origin),'TO:',
           dest);  underline(3,74);
    writeln(out,' ':3,'MARKS & NOS.',' ':29,'DESCRIPTION');
    writeln(out,' ':3,'-------------',' ':29,'----------');
    skip(2);
    writeln(out,' ':44,commodity);writeln(out);
    writeln(out,' ':33,'Container*     Bales       Net Weight(lbs)');
    writeln(out,' ':33,'---------      -----       -------------');
    writeln(out);
  END
END;
```

```
PROCEDURE bshippaklist;
BEGIN
  WITH fsscontract,fssshiprec DO
  BEGIN
     FOR k := 1 TO nofcont DO
     WITH container[k] DO
     BEGIN
        prealtostr(net,format1);addcomma(format1);
        writeln(out,' ':33,number,' ':15-LENGTH(number),bales:6,
                ' ':5,format1:10)
     END;
     writeln(out,' ':33,'-----------------------------------');
     write(out,' ':3,nofcont,' X 40 FOOT CONTAINERS');
     STR(totalbales,format1);addcomma(format1);
     prealtostr(totalnet,format2);addcomma(format2);
     writeln(out,' ':9,'Total',format1:9,' Bales',format2:13,' lbs');
     writeln(out,' ':33,format2:10,' lbs =',shpamtintons:10:3,
                              ' shorttons');
     writeln(out,' ':33,'===================================');
     signature
     END
END;

PROCEDURE acertorigin;
BEGIN
   WITH fsscontract,fssshiprec  DO
   BEGIN
      skip(6);writeln(out,' ':12,'Shunsuke Hanaoka');writeln(out);
      writeln(out,    Kobe Merchantile, Inc., 861 Six Ave.,',
              ' San Diego, CA. 92101');
      writeln(out);writeln(out,' ':30,'M /  ',name);writeln(out);
      write(out,' ':9,calendar[etd.month],' ',etd.day,' ,19',
              etd.year,' ':11,customer.name);
      IF LENGTH(customer.addr) <= 35
        THEN BEGIN
             writeln(out,',  ',customer.addr);
             skip(5)
             END
        ELSE BEGIN
            i := 35;
            REPEAT i := i - 1 UNTIL customer.addr[i] = ' ';
            firsthalf := COPY(customer.addr,1,i-1);
            sechalf  := COPY(customer.addr,i+1,
                                      LENGTH(customer.addr)- i);
            writeln(out,',  ',firsthalf);writeln(out);
```

```
            writeln(out,'  ',sechalf);
            skip(3)
            END;
  END
END;

PROCEDURE bcertorigin;
BEGIN
   WITH fsscontract,fssshiprec DO
   BEGIN
      writeln(out,' ':46,commodity); skip(3);
      FOR k := 1 TO nofcont DO
         writeln(out,' ':4,container[k].number);
      skip(2);
      writeln(out,' ':18,nofcont,' X 40 FOOT');
      prealtostr(totalnet,format2);addcomma(format2);
      writeln(out,' ':18,'CONTAINERS',' ':7,format2,' lbs');
      skip(2);
      writeln(out,' ':15,'THESE COMMODITIES LICENSED BY THE U.S.'
            ,' FOR ULTIMATE DESTINATION');
      writeln(out,' ':15,'JAPAN.  DIVERSION CONTRARY TO U.S.
            LAW PROHIBITED');
      skip(26-nofcont);
      writeln(out,' ':5,'Chamber of Commerce of San Diego');
      writeln(out,' ':41,'California')
   END
END;  (* bcertorigin *)

PROCEDURE aphytocert;
BEGIN
   WITH fsscontract,fssshiprec DO
   BEGIN
      prompt(sciname,3,choice);write(chr(12));
      skip(9); writeln(out,' ':33,'JAPAN'); skip(18);
      writeln(out,' ':28,'Kobe Merchantile,Inc., 861 Six Ave.,
                  San Diego, CA 92101');
      writeln(out,' ':28,customer.name,',');
      writeln(out,' ':28,customer.addr);writeln(out);
      writeln(out,' ':38,shpamtintons:7:3,' shorttons of ');
      writeln(out);
      writeln(out,' ':38,commodity); writeln(out);
      writeln(out,' ':38,sciname[choice]); writeln(out);
      writeln(out,' ':30,nofcont,'  X 40 Foot Containers');
      IF nofcont <= 5 THEN writeln(out); i := 0; oneline := 0;
      REPEAT
```

```
        write(out,' ':20);
        oneline := oneline + 5;
        REPEAT
          i := i + 1;
          write(out,container[i].number:LENGTH(container[i].
                                              number),',')
        UNTIL (i = nofcont - 1) OR (i = oneline);
        IF i = nofcont - 1
          THEN writeln(out,container[nofcont].number)
          ELSE writeln(out)
      UNTIL i = nofcont - 1;
      IF nofcont <= 10 THEN writeln(out);
  END
END;

PROCEDURE bphytocert;
BEGIN
  WITH fsscontract,fssshiprec DO
  BEGIN
    writeln(out,' ':14,'Imperial County,California');
    writeln(out);
    writeln(out,' ':21,'Ocean Vessel',' ':25,'Japan');
    skip(3);
    write(out,' ':15,'This ',commodity,',',sciname[choice]);
    FOR i := 1 TO LENGTH(sciname[choice]) DO
      write(out,chr(8));      { backspace }
    FOR i := 1 TO LENGTH(sciname[choice]) DO
      write(out,'_');          { underline } skip(2);
    writeln(out,' ':15,'was grown in the Imperial County,
                        California. The Hessian Fly,');
    writeln(out);
    write(out,' ':15,'Phytophaga Destructor (Say)');
    FOR i := 1 TO 27 DO
      write(out,chr(8));
    FOR i := 1 TO 27 DO
      write(out,'_');
    writeln(out,' is not known to occur in');writeln(out);
    writeln(out,' ':15,'the Imperial County,California.');
  END   { with }
END;

PROCEDURE fumigation;
BEGIN
  WITH fssshiprec DO
  BEGIN
```

```
      skip(28);
      IF nofcont <= 10
        THEN FOR k := 1 TO nofcont DO
               writeln(out,' ':15,container[k].number)
        ELSE FOR k:= 1 TO 10 DO
               BEGIN
                 write(out,' ':15,container[k].number);
                 IF k+10 <= nofcont
                   THEN writeln(out,' ':10,container[k+10].number)
                   ELSE writeln(out)
               END;
      IF nofcont <= 10 THEN skip(13-nofcont)
                       ELSE skip(3);
      i := 0;
      { seperate the shipname and voyage number }
      REPEAT
         i := i + 1
      UNTIL (name[i]='V')  OR (name[i]='v') OR (i=LENGTH(name));
      IF (name[i] <> 'v') AND (name[i] <> 'V')
         THEN BEGIN
               REPEAT   { get the voy# since not given }
                 write(chr(12),'No voyage number, voyage #:');
                 readln(format2)
               UNTIL format2 <> ' '; format1 := name;
               write(chr(12))
               END
         ELSE BEGIN
              format1 := COPY(name,1,i-1);
              format2 := COPY(name,i,LENGTH(name)-i+1)
              END;
      writeln(out,' ':40,format1);  writeln(out);
      writeln(out,' ':21,format2,' ':28,dest)
      END  { with }
  END;

BEGIN
   (* initialize *)
   calendar[1]  := 'January';    calendar[2] := 'February';
   calendar[3]  := 'March';      calendar[4] := 'April';
   calendar[5]  := 'May';        calendar[6] := 'June';
   calendar[7]  := 'July';       calendar[8] := 'August';
   calendar[9]  := 'September';  calendar[10] := 'October';
   calendar[11]  = 'November'; calendar[12]  = 'December';

   REWRITE(out,'PRINTER:');
```

```
casecnt := 0;
REPEAT
   casecnt := casecnt + 1;
   CASE casecnt OF
   1 : BEGIN
       write(chr(12),at(0,3),
       'Turn on the TEC, insert the INVOICE sheet and press
                                                  <RETURN>');
       readln;
       ashipinv;
       bshipinv
       END;
   2 : BEGIN
       write(at(0,3),
       'Now put the PACKING LIST sheet and press <RETURN> ');
       readln;
       ashippaklist;
       bshippaklist
       END;
   3 : BEGIN
       write(at(0,3),
       'Certificate of Origin sheet, Press <RETURN> when ready');
       readln;
       acertorigin;
       bcertorigin;
       END;
   4 : BEGIN
       write(at(0,3),
       'Phytosanitary Certificate sheet, press <RETURN> when
            ready ');
       readln;
       aphytocert;
       bphytocert
       END;
   5 : BEGIN
       write(at(0,3),
       'Fumigation Certificate sheet, press <RETURN> when
            ready ');
       readln;
       fumigation
       END
 END;
 write(at(0,3),' ':78);
 write(at(0,3),'Repeat?(y/n)'); read(ch);
 IF ch IN ['Y','y'] THEN casecnt := casecnt - 1
```

```
  UNTIL casecnt = 5;CLOSE(out)
END;  (* shippaperwork *)
```

```
SEGMENT PROCEDURE fspshipment;
VAR choice,loc,sfloc,i,j,m,old,mm : integer;
      done : boolean;
      inp : string[10];
      shpamtintons,rate,rate1,rate2,cutwgt : real;
      ch : char;

PROCEDURE truckconvert(line:characters;VAR tr : trucktype);
CONST blank = ' ';
VAR temp : trucktype;
      i,j,max,start : integer;
      gross,tare : real;
      item : characters;
BEGIN
   line := CONCAT(line,'$');
   WITH temp DO
   BEGIN
     mthday := blank;wgtticketno := blank;net := 0;bales := 0;
   END;
   i := 1; j := 1;max := LENGTH(line);
   REPEAT
      WHILE(line[i] = blank) AND (i < max) DO
        i := i + 1;
        start := i;
      WHILE(line[i] <> blank) AND (i < max) DO
        i := i + 1;
      item := COPY(line,start,i-start);
      CASE j OF
      1 : temp.mthday := item;
      2 : temp.wgtticket := item;
      3 : temp.bales := conint(item);
      4 : gross := conreal(item);
      5 : BEGIN
          tare := conreal(item);
          temp.net := gross - tare
          END
      END; (* case *)
      j := j + 1
   UNTIL (j > 5) OR (i = max);
   tr := temp
END;

PROCEDURE gettruckrate;
VAR j : integer; inp : characters;
```

```
BEGIN
   j := 0;
   REPEAT
     j := j + 1;
     CASE j OF
     1 : BEGIN
         write(chr(12),at(0,2),'Cutting point weight:');
         readln(inp);
         IF inp <> ' '
           THEN cutwgt := conreal(inp)
           ELSE j := j - 1
         END;
     2 : BEGIN
         write(at(0,4),'Rate below cut point:');
         readln(inp);
         IF inp <> ' '
           THEN rate1 := conreal(inp)
           ELSE j := j - 1
         END;
     3 : BEGIN
         write(at(0,6),'Rate above cut point:');
         readln(inp);
         IF inp <> ' '
           THEN rate2 := conreal(inp)
           ELSE j := j - 1
         END;
     END;  { case }
END;  { gettruckrate }

PROCEDURE truckcostcomp;
VAR truckmenu : menutype;
    ch : char;
    choice : integer;
BEGIN
  truckmenu[0] := 'Truck rate computation';
  truckmenu[1] := 'By shorttons';
  truckmenu[2] := 'By bales';
  fspshiprec.totaltruckcost := 0;
  REPEAT
    prompt(truckmenu,2,choice);
    write(at(0,10),'Compute ',truckmenu[choice],' is it correct?
                                                (y/n)');
    read(ch)
  UNTIL ch IN ['Y','y'];
  WITH fspshiprec DO
```

```
    BEGIN
    CASE choice OF
    1 : BEGIN
        { get the rates }
        REPEAT
           gettruckrate;
           write(at(0,22),'Input OK?(y/n)');
           read(ch); write(at(0,22),' ':30)
        UNTIL ch IN ['Y','y'];
        { compute }
        FOR i := 1 TO noftruck DO
        BEGIN
           IF truck[i].net/2000.0 < cutwgt
             THEN truck[i].cost := (truck[i].net/2000.0) * rate1
             ELSE truck[i].cost := (truck[i].net/2000.0) * rate2;
           totaltruckcost := totaltruckcost + truck[i].cost
        END
        END;
    2 : BEGIN
        { get the rates }
        REPEAT
           gettruckrate;
           write(at(0,22),'Input OK?(y/n)');
           read(ch); write(at(0,22),' ':30)
        UNTIL ch IN ['Y','y'];
        { compute }
        FOR i := 1 TO noftruck DO
        BEGIN
          IF truck[i].bales < cutwgt
            THEN truck[i].cost := rate1
            ELSE truck[i].cost := (truck[i].bales/cutwgt) * rate2;
          totaltruckcost := totaltruckcost + truck[i].cost
        END
        END
    END; { case }
  END; { with }
END;

PROCEDURE fspcompute;
BEGIN
WITH fspcontract DO
BEGIN
  i := 1; (* find out which months *)
  write(chr(12),at(18,0),'month      @price');
  REPEAT
```

```
      write(at(20,i),timeofship[i].month:2,'    $',
            timeofship[i].unitprice:7:2);
      i := i + 1;
    UNTIL (i > 6) OR (timeofship[i].month = 0);

REPEAT
    write(at(20,10),'Month = ');
    readln(inp);
    IF inp <> ' '
      THEN BEGIN
            mm := conint(inp);
            i := 0;
            REPEAT
              i := i + 1; m := i;
            UNTIL (timeofship[i].month = mm) OR (i = 7);
            IF i = 7
              THEN BEGIN
                    write(at(20,12),'No such month listed,
                              press <RETURN>'0;
                    readln
                    END
            END
UNTIL (timeofship[i].month = mm) AND (inp <> ' ');

shpamtintons := fspshiprec.totalnet / 2000;
timeofship[m].bal := timeofship[m].bal - shpamtintons;
balofship := balofship - shpamtintons;
fspshiprec.payment := shpamtintons * timeofship[m].unitprice;

truckcostcomp;  { compute the truck cost }

{ now save into the fspshipfile first }
fspshipfile^ := fspshiprec;
SEEK(fspshipfile,sfloc);
PUT(fspshipfile); CLOSE(fspshipfile);

{ output some information }
write(chr(12),at(0,2),'Total of ',shpamtintons:8:3,' shorttons');
write(at(0,4),'Payment is $',fspshiprec.payment:10:2);
write(at(0,6),'Press <RETURN>'); readln;

IF (timeofship[m].bal < 0) AND (timeofship[m+1].month <> 0)
  THEN timeofship[m+1].bal := timeofship[m+1].bal +
                              timeofship[m].bal;
```

```
IF nofshipment <> 0
   THEN BEGIN                          (* more than one shipments so *)
        i := 0;j := shipmentinfo;(* link up the shipment records *)
        RESET(fspshipfile,'#5:fspshipfile');
        REPEAT
          SEEK(fspshipfile,j);old := j;
          GET(fspshipfile);
          j := fspshipfile^.link; i := i + 1
        UNTIL i := nofshipment;
        fspshipfile^.link := sfloc;
        SEEK(fspshipfile,old); PUT(fspshipfile);
        CLOSE(fspshipfile);  (* put back into the original place *)
        END
    ELSE shipmentinfo := sfloc; (* first shipment *)
  nofshipment := nofshipment + 1;
END;  (* with *)
END;  (* fspcompute *)

PROCEDURE getpurshipinfo;
VAR k,lineno,xaxis : integer;
     ch : char;
     finish,goon : boolean;
     temp : characters;
     tempdate : datetype;

FUNCTION psproceed : boolean;
BEGIN
   IF EOF THEN BEGIN RESET(INPUT);EXIT(fspshipment) END
   ELSE IF temp = ' '
     THEN BEGIN
           psproceed := false;
           lineno := lineno - 1
           END
     ELSE psproceed := true
END;

PROCEDURE  nextpurshipinput;
BEGIN
   WITH fspshiprec DO
   BEGIN
     write(at(0,2),
     '  Date     Wgt ticket #   Bales    Gross   Tare   Net ');
     write(at(0,lineno+2),lineno:2,'.   ');
     readln(temp);
     finish := (temp = 'F') OR (temp = 'f'0;
```

```
    IF (psproceed) AND (NOT finish)
      THEN BEGIN
             truckconvert(temp,truck[lineno]);
             write(at(62,lineno+2),truck[lineno].net:8:1);
             totalbales := totalbales + truck[lineno].bales;
             totalnet := totalnet + truck[lineno].net;
             IF lineno > noftruck THEN noftruck := lineno
              {nessary not to reset noftruck when called from
                          purshipmodify}
             END;
    IF finish
      THEN write(at(0,lineno+2),' ':70)
  END { with }
END; (* nextpurshipinput *)

PROCEDURE purshipmodify;
BEGIN
  REPEAT
    REPEAT
      goon := true;
      write(at(55,22),'Which line to change:'0;
      readln(lineno);write(at(55,22),' ':24);
      IF (lineno < 1) OR (lineno > fspshiprec.noftruck)
        THEN BEGIN
             write(at(50,22),chr(7),'No such line, press
                                                <RETURN>');
             readln;write(at(50,22),' ':25);goon := false
             END
    UNTIL goon;
    (* now erase the line to be changed *)
    WITH fspshiprec DO
    BEGIN
      write(at(4,lineno+2),' ':70);
      totalbales := totalbales - truck[lineno].bales;
      totalnet := totalnet - truck[lineno].net
    END;
    (* read the modifying line *)
    nextpurshipinput;
    write(at(55,22),'OK now?(y/n)');read(ch)
  UNTIL ch IN ['Y','y']
END;  (* purshipmodify *)

BEGIN  (* getpurshipinfo *)
  lineno := 1; fspshiprec.totalbales := 0;
  fspshiprec.totalnet := 0;fspshiprec.noftruck := 0;
```

```
  write(chr(12));  { clear screen }
  REPEAT
     nextpurshipinput;
     lineno := lineno + 1
  UNTIL (lineno > 20) OR (finish);
  fspshiprec.status := occupied;
  write(at(55,22),'Input OK?(y/n)');read(ch);
  IF ch IN ['N','n'] THEN purshipmodify
END;

BEGIN (* fspshipment *)
   RESET(fsphashfile,'#5:fsphashfile');
   REPEAT (* till the correct contract no given *)
      done := true;
      REPEAT
        write(chr(12),at(x,3),'Contract number:');
        readln(contractno)
      UNTIL (contractno <> ' ') OR EOF;
      IF EOF THEN BEGIN RESET(INPUT);CLOSE(fsphashfile);
      EXIT(fspshipment) END;
      i := -1;
      REPEAT
        i := 1 = 1;
        SEEK(fsphashfile,i);
        GET(fsphashfile)
      UNTIL (EOF(fsphashfile)) OR (fsphashfile^.number =
                                        contractno);

      IF EOF(fsphashfile)
        THEN REPEAT
              prompt(error2,3,choice);
              CASE choice OF
              1 : BEGIN CLOSE(fsphashfile);EXIT(fspshipment) END;
              2 : BEGIN CLOSE(fsphashfile);fspinquery END;
              3 : done := false
              END;
              UNTIL choce = 3
        ELSE BEGIN (* ok find the contract info from fspfile *)
              loc := fsphashfile^.link; CLOSE(fsphashfile);
              RESET(fspfile,'#5:fspfile');
              SEEK(fspfile,loc);
              GET(fspfile); fspcontract := fspfile^;
              CLOSE(fspfile)
              END;
    UNTIL done;
```

```
    getpurshipinfo;
    (* put this info into the fspshipfile *)
    RESET(fspshipfile,'#5:fspshipfile');sfloc := -1;
    REPEAT
      sfloc := sfloc + 1;
      SEEK(fspshipfile,sfloc);
      GET(fspshipfile)
    UNTIL (EOF(fspshipfile)) OR (fspshipfile^.status = empty);
    write(at(0,22),'sfloc = ',sfloc);

    IF EOF(fspshipfile)
      THEN BEGIN
            CLOSE(fspshipfile);
            write(chr(12),chr(7),at(x,2),
               'DOOMESDAY no more space in the file');
            write(at(x,3),'Please call the system designer');
            write(at(x,4),'Meantime press <RETURN>
                           and do other work');
            readln; EXIT(fspshipment)
            END;

  (* make the necessary computation and save it *)
  fspcompute;

  (* now put it into the fspfile *)
  RESET(fspfile,'#5:fspfile');
  fspfile^ := fspcontract;
  SEEK(fspfile,loc);PUT(fspfile);
  CLOSE(fspfile);
END; (* fspshipment *)

SEGMENT PROCEDURE listpurcontr; (*purchase contract info *)
VAR k : integer;
BEGIN
   WITH fspcontract DO
   BEGIN
     write(chr(12),at(15,0),'Feed Stuff Purchase Contract
                                          Information ');
     write(at(x,1),fspnewconmenu[1],' ',number);
     write(at(x,2),fspnewconmenu[2],' ',contrdate.month,'/',
           contrdate.day,'/',contrdate.year);
     write(at(x,3),fspnewconmenu[3],' ',farmer.name);
     write(at(x,4),fspnewconmenu[4],' ',farmer.addr);
     write(at(x,5),fspnewconmenu[5],' ',commodity);
```

```
    k := 1;
    write(at(x,6),
    'Time of shipment   :  Months Quantity Balance Unitprice');
    REPEAT
      write(at(29+x,6+x),timeofship[k].month:2,timeofship[k].wgt
       :10,timeofship[k].bal:12:2,'  $',timeofship[k].unitprice:8:2);
      k := k + 1
    UNTIL (timeofship[k].month = 0) OR (k > 6);
    write(at(x,6+k),'total shipment     :',totalship:8:2);
    write(at(x,7+k),'balance of shipment:',balofship:8:2);
    write(at(x,8+k),'* of shipment made:',nofshipment)
  END;
END;  (* listpurcontr *)

SEGMENT PROCEDURE prlistpurcontr;  (* contract infor to printer *)
VAR k : integer;
BEGIN
  WITH fspcontract DO
  BEGIN
    skip(4);
    writeln(out,' ':20,'Feed Stuff Purchase Contract Information');
    skip(3);
    writeln(out,' ':10,fspnewconmenu[1],' ',number);writeln(out);
    writeln(out,' ':10,fspnewconmenu[2],' ',contrdate.month,'/',
            contrdate.day,'/',contrdate.year);  writeln(out);
    writeln(out,' ':10,fspnewconmenu[3],' ',farmer.name);
    writeln(out);
    writeln(out,' ':10,fspnewconmenu[4],' ',farmer.addr);
    writeln(out);
    writeln(out,' ':10,fspnewconmenu[5],' ',commodity);
    writeln(out);
    skip(2);  k := 1;
    writeln(out,' :10,
    'Time of shipment   :  Months Quantity Balance Unitprice');
    REPEAT
      writeln(out,' ':39,timeofship[k].month:2,timeofship[k].wgt:10,
           timeofship[k].bal:12:2,'  $',timeofship[k].unitprice:8:2);
      k := k + 1
    UNTIL (timeofship[k].month = 0) OR (k > 6);  skip(2);
    writeln(out,' ':10,'total shipment          :',totalship:8:2);
    writeln(out);
    writeln(out,' ':10,'balance of shipment  :',balofship:8:2);
    writeln(out);
    writeln(out,' ':10,'* of shipment made  :',nofshipment)
  END;
```

```
END;  (* prlistpurcontr *)

SEGMENT PROCEDURE purcontrinfo;
VAR i,j,k,num,entries,loc : integer;
    commoname : string[25];
    quit : boolean;
    commodlist : intype;
    ch : char;
    twodeci,str1,str2,str3 : characters;

PROCEDURE listpurship;
BEGIN
  WITH fspshiprec DO
  BEGIN
    write(chr(12),at(0,0),'Shipment No. ',num:2);
    write(at(5,1),'Date',at(18,1),'Wgt tkt#',at(33,1),'Bales',at(41,1),
          'Net Wgt',at951,1),'Cost');
    FOR k := 1 TO noftruck DO
      WITH truck[k] DO
      BEGIN
        prealtostr(net,str3);addcomma(str3);
        write(at(5,2+k),mthday,at(18,2+k),wgtticketno,
              at(31,2+k),bales:5,at(40,2+k),str3:7,cost:9:2)
      END;
    STR(totalbales,str1);addcomma(str1);
    write(at(0,4+noftruck),'Total bales =',str1);
    prealtostr(totalnet,str2);addcomma(str2);
    write(0,5+noftruck),'Total net  =',str2);
    dollarcent(payment,twodeci);addcomma(twodeci);
    write(at(0,6+noftruck),'Payment   =$',twodeci);
    dollarcent(totaltruckcost,str3);addcomma(str3);
    write(at(0,8+noftruck),'truck cost  =$',str30;
  END
END;

PROCEDURE printpurship;
BEGIN
WITH fspshiprec DO
BEGIN
  write(at(0,22),' ':70);
  write(at(0,22),'Need a printout?(y/n)');
  read(ch);IF EOF THEN BEGIN RESET(INPUT);EXIT(printpurship)
  END;
  IF ch IN ['Y','y']
    THEN BEGIN
```

```
            write(at(0,22),'Turn on the TEC and press <RETURN>');
            readln;
            REWRITE(out,'PRINTER:'); skip(4);
            writeln(out,'   Shipment No.',num:2);writeln(out);
            writeln(out,' ':4,'Date',' ':14,'Wgt ticket#',' ':5,'Bales',
                    ' ':5,'Net Wgt',' ':5,'Cost'); skip(2);
            FOR k := 1 TO noftruck DO
               WITH truck[k] DO
               BEGIN
                  prealtostr(net,str3);addcomma(str3);
                  writeln(out,' ':4,mthday,' ':12,wgtticketno:12,
                          ' ':5,bales:5,' ':5,str3:7,' ':5,cost:7:2);
                  writeln(out)
               END;
            STR(totalbales,str1);addcomma(str1);
            prealtostr(totalnet,str2);addcomma(str2);
            dollarcent(totaltruckcost,str3);addcomma(str3);
            dollarcent(payment,twodeci);addcomma(twodeci);
            writeln(out);
            writeln(out,' ':5,'Total bales =',str1);writeln(out);
            writeln(out,' ':5,'Total net   =',str2);writeln(out);
            writeln(out,' ':5,'Payment   =$',twodeci:10);writeln(out);
            writeln(out,' ':5,'Truck cost =$',str3:10);
          COLSE(out)
          END
END;   (* with *)
END;

PROCEDURE subpurcontr;  { for shipment info }
BEGIN
   IF fspcontract.nofshipment > 0 THEN
   BEGIN
   write(at,(0,22),
    'Like to see all shipments in sequence?(y/n/<ctrl-c> to quit)');
   read(ch);IF EOF THEN BEGIN RESET(INPUT);EXIT(subpurcontr)
             END;
   IF ch IN ['Y','y']
     THEN BEGIN
          i := 0;j := fspcontract.shipmentinfo;
          RESET(fspshipfile,"#5:fspshipfile');
          REPEAT
             SEEK(fspshipfile,j);
             GET(fspshipfile);
             j := fspshipfile^.link;
             fspshiprec := fspshipfile^;
```

```
            num := i + 1; { used in printing proc }
            listpurship; printpurship; i := i + 1;
            IF i < fspcontract.nofshipment
              THEN BEGIN
                   write(at(0,22),'Want to see next shipment?
                         (y/n)   ');
                   read(ch);write(at(0,22),' ':50);
                   IF EOF THEN BEGIN CLOSE(fspshipfile);
                                     RESET(INPUT);
                                     EXIT(subpurcontr) END
                   END
          UNTIL (i = fspcontract.nofshipment) OR (ch IN ['N','n']);
          CLOSE(fspshipfile);
          END
      ELSE  BEGIN
            REPEAT
              write(at(0,220,' ':70);   (* erase previous line *)
              REPEAT
                write(at(0,22),'Which shipment(<ctrl-c> to quit):');
                read(num);IF EOF THEN BEGIN RESET(INPUT);
                                            EXIT(subpurcontr)
                                      END
              UNTIL (num>=1) AND
                           (num<=fspcontract.nofshipment);
              (* locat the shipment info *)
              i := 0; j := fspcontract.shipmentinfo;
              RESET(fspshipfile,'*5:fspshipfile');
              REPEAT
                SEEK(fspshipfile,j);
                GET(fspshipfile);
                j := fspshipfile^.link; i := i + 1
              UNTIL i:= num;
              fspshiprec := fspshipfile^; CLOSE(fspshipfile);
              listpurship; printpurship;
              write(at(0,22),'Like to see another shipment?(y/n)');
              read(ch);
              IF EOF THEN BEGIN RESET(INPUT);EXIT(subpurcontr)
                          END
        UNTIL ch IN ['y','Y']
        END  (* else *)
  END
END;

BEGIN  (* purcontrinfo *)
  REPEAT
```

```
    write(chr(12),at(x,3),'Contract number:');
    readln(contractno);
  UNTIL (contractno <> ' ') OR EOF;(* not empty or terminate *)
  IF EOF THEN BEGIN RESET(INPUT);EXIT(purcontrinfo) END;
  RESET(fsphashfile,'#5:fsphashfile'); i := - 1;
  REPEAT
     i := i + 1;
     SEEK(fsphashfile,i);
     GET(fsphashfile)
  UNTIL (EOF(fsphashfile) OR (fsphashfile^.number = contractno);

  IF EOF(fsphashfile)  (* not found *)
     THEN BEGIN
          CLOSE(fsphashfile);
          write(at(x,5),chr(70,'No such contract in the file');
          write(at(x,7),'Press <RETURN>'); readln;
          END
     ELSE BEGIN
          CLOSE(fsphashfile);
          loc := fsphashfile^.link;
          RESET(fspfile,'#5:fspfile');
          SEEK(fspfile,loc);GET(fspfile);CLOSE(fspfile);
          fspcontract := fspfile^;
          listpurcontr;
          { prntout to the printer if desired }
          write(at(0,22),'Need a printout?(y/n));read(ch);
          IF EOF THEN BEGIN RESET(INPUT);EXIT(purcontrinfo) END;
          IF ch IN ['Y','y']
             THEN BEGIN
                  write(at(0,22),'Turn on the TEC and press
                                                  <RETURN>');
                  readln;REWRITE(out,'PRINTER:');
                  prlistpurcontr; CLOSE(out)
                  END;
          subpurcontr { to list/print shipment information }
          END;
END;

SEGMENT PROCEDURE fspresiduecheck;
VAR j,opencnt : integer;
BEGIN
  write(chr(12),at(x,2),'Available Spaces'); opencnt := 0;
  write(at(x,4),'Contract file: ');
  j := 0; RESET(fspfile,'#5:fspfiel');
  SEEK(fspfile,j); GET(fspfile);
```

```
  WHILE NOT EOF(fspfile) DO
  BEGIN
    IF fspfile^.status = empty
      THEN BEGIN
             opencnt := opencnt + 1;
             write(at(x+19,4),opencnt:3)
             END;
    j := j + 1;
    SEEK(fspfile,j);
    GET(fspfile)
  END;
  CLOSE(fspfile);
  opencnt := 0; j := 0;
  write(at(x,5),'Shipment file: ');
  RESET(fspshipfile,'#5:fspshipfile');
  SEEK(fspshipfile,j); GET(fspshipfile);
  WHILE NOT EOF(fspshipfile) DO
  BEGIN
    IF fspshipfile^.status = empty
      THEN BEGIN
             opencnt := opencnt + 1;
             write(at(x+19,5),opencnt:3)
             END;
    j := j + 1;
    SEEK(fspshipfile,j);
    GET(fspshipfile)
  END;
  CLOSE(fspshipfile);
  write(at(x,7),'Press <RETURN>'); readln
END;  { fspresiduecheck }

SEGMENT PROCEDURE fspinquery;
VAR i,j,k,num,entries,loc : integer;
    commoname : string[25];
    quit : boolean;
    commodlist : intype;
    ch : char;
    twodec1,str1,str2,str3 : characters;
BEGIN (* fspinquery *)
  quit := false;
  REPEAT
    prompt(fspquerymenu,5,choice);
    CASE choice OF
    1 : BEGIN
          RESET(fsphashfile,'#5:fsphashfile');
```

```
        write(chr(12),at(15,0),'List of all commodities');
        entries := 1; commodlist[1] := ' '; j := -1;
        REPEAT
          REPEAT
             j := j + 1;
             SEEK(fsphashfile,j);
             GET(fsphashfile)
          UNTIL (EOF(fsphashfile)) OR (fsphashfile^.status <>
                                                 empty);
          IF NOT EOF(fsphashfile)
            THEN BEGIN
                 i := 1;
                 (* check if this record's name is already in
                    commodity array, if not put it *)
                 WHILE (i < entries) AND
                 (fsphashfile^.commodity <> commodlist[i]) DO
                     i := i + 1;
                 IF i := entries
                 (* not in customers array so put it in *)
                   THEN BEGIN
                        commodlist[i] :=
                              fsphashfile^.commodity;
                        entries := entries + 1
                        END;
                 END
        UNTIL EOF(fsphashfile);
        CLOSE(fsphashfile); i := 1;
        WHILE i <= entries - 1 DO
        BEGIN
          IF validate(commodlist[i])
            THEN write(at(x,i),commodlist[i]);
          i := i + 1
        END;
        write(at(55,22),'Press <RETURN>'); readln
      END;
2 : BEGIN
      REPEAT
        write(chr(12),at(x,3),'Commodity name:');
        readln(commoname)
      UNTIL (commoname <> ' ') OR EOF;
       (* not empty or terminate *)
      IF EOF THEN BEGIN RESET(INPUT);EXIT(fspinquery) END;
      RESET(fsphashfile,'*5:fsphashfile');
      write(chr(12),at(15,0),'Contracts of',commoname);
      j := 2;
```

```
            FOR i := 0 TO max DO
            BEGIN
               SEEK(fsphashfile,i);
               GET(fsphashfile);
               IF (fsphashfile^.status = occupied)
                 AND (fsphashfile^.commodity = commoname)
                THEN BEGIN
                      write(at(x,j),fsphashfile^.number,'    ',
                                          fsphashfile^.name);
                      j := j + 1
                      END;
               IF j = 22    (* full screen *)
                 THEN BEGIN
                       write(at(55,22),'Press <RETURN>');
                       readln; write(chr(12); j := 2
                       END;
            END;
            write(at(55,22),'Press <RETURN>'); readln;
            CLOSE(fsphashfile)
          END;
      3 : purcontrinfo;
      4 : fspresiduecheck;
      5 : quit := true;
      END; (* case *)
   UNTIL quit
END;

SEGMENT PROCEDURE fspnew;
(* to add new feed stuff contract and setup the data structure
   accordingly *)
VAR lineno,j,k,loc,choice,addr,i : integer;
      goon,finish,done,located : boolean;
      temp : characters;
      ch : char;
      tempdate : datetype;

PROCEDURE tosconvert(line:characters;VAR tos:tostype);
CONST blank = ' ';
VAR temp : tostype;
      i,j,max,start : integer;
      item : characters;
BEGIN
   line := CONCAT(line,'$');
   max := LENGTH(line);
   WITH temp DO
```

```
    BEGIN
      month := 0; wgt := 0; bal := 0; unitprice := 0
    END;
    i := 1; j := 1;
    REPEAT
      WHILE(line[i] = blank) AND (i < max) DO
        i := i + 1;
      item := COPY(line,start,i-start);
      CASE j OF
      1 : temp.month := conint(item);
      2 : BEGIN
            temp.wgt := conint(item);
            temp.bal := temp.wgt
          END;
      3 : temp.unitprice := conreal(item)
      END; (* case *)
      j := j + 1
    UNTIL (j > 3) OR (i = max);
    tos := temp
END; (* tosconvert *)

PROCEDURE getfspinfo;
(* get all the information for the new contract *)

FUNCTION pproceed : boolean;
BEGIN
    IF EOF THEN BEGIN RESET(INPUT);EXIT(fspnew) END
    ELSE IF (lineno <> 6) AND (temp = ' ')
        THEN BEGIN
               pproceed := false;
               lineno := lineno - 1
               END
    ELSE IF (lineno = 6) AND (temp = ' ')
        THEN BEGIN
               pproceed := false;
               k := k - 1
               END
        ELSE pproceed := true
END;

PROCEDURE nextpurinput;
BEGIN
    WITH fspcontract DO
      CASE lineno OF
      1,3,4,5:
```

```
        BEGIN
        write(at(x,lineno),lineno:2,'. ',fspnewconmenu[lineno]);
        readln(temp);
        IF pproceed
          THEN CASE lineno OF
                 1 : number := temp;
                 3 : farmer.name := temp;
                 4 : farmer.addr := temp;
                 5 : commodity := temp;
                 END; (* case *)
        END;
    2 : BEGIN
        write(at(x,2),' 2. ',fspnewconmenu[2]);
        readln(temp);
        IF pproceed
          THEN BEGIN
                 dateconvert(temp,contrdate);
                 IF datecheck(contrdate) <> ok
                   THEN BEGIN
                          write(at(38,2),'Error in input,press
                                                    <RETURN>');
                          readln;write(at(38,2),' ':30);
                          lineno := lineno - 1
                          END
                 END
        END;
    6 : BEGIN
          WITH fspcontract DO
          BEGIN
            totalship := 0;
            write(at(x,9),' 6. ',fspnewconmenu[6]);
            finish := false; k := 0;
            REPEAT
              k := k + 1;
              GOTOXY(x+33,9+k); readln(temp);
              finish := (temp = 'F') OR (temp = 'f');
              IF (pproceed) AND (NOT finish)
                THEN BEGIN
                       tosconvert(temp,timeofship[k]);
                       IF (timeofship[k].month < 1) OR
                            (timeofship[k].month > 12)
                         THEN BEGIN
                                write(at(x+30,9+k),
                                  'Error in input,press <RETURN>');
                                readln;
```

```
                                write(at(x+30,9+k),' ':30); k := k - 1
                                END
                            ELSE totalship := totalship +
                                                timeofship[k].wgt
                        END;
            UNTIL (k = 6) OR (finish);
            balofship := totalship;
            IF k < 6 THEN BEGIN
                        write(at(x+30,9+k),' ':30);
                        timeofship[k].month := 0
                        (* 0 is endofdata marker *)
                        END
    END
    END;
END; (* case *)
END; (* nextpurinput *)

PROCEDURE fspmodify;
(* to modify the fspcontract input information *)
BEGIN
  REPEAT
    REPEAT
      goon := true;
      write(at(55,22),'Which line to change:');
      readln(lineno); write(at(55,22),' ':24);
      IF (lineno < 1) OR (lineno > 6)
        THEN BEGIN
              write(at(55,22),chr(7),'No such line!Press <RET>');
              readln;write(at(55,22),' ':25);goon := false
              END
    UNTIL goon;
    (* now erase the line to be changed *)
    IF lineno <= 5
      THEN BEGIN
            write(at(38,lineno),' ':40);
            GOTOXY(38,lineno)
            END
      ELSE FOR j := 1 TO k DO
              write(at(43,9+j),' ':20);
              (* no GOTOXY here since it is in case 6: *)
     nextpurinput;
     write(at(55,22),'OK now?(y/n)');
     read(ch);
  UNTIL (ch = 'Y') OR (ch = 'y')
END; (* fspmodify *)
```

```
BEGIN
   write(chr(12),at(15,0),fspnewconmenu[0]);
   lineno := 1;
   REPEAT
      nextpurinput;
      lineno := lineno + 1
   UNTIL lineno > 6;
fspcontract.nofshipment := 0; fspcontract.status := occupied;
write(at(55,22),'Input OK?(y/n)');
read(ch); IF (ch = 'N') OR (ch = 'n') THEN fspmodify
END; (* getfspinfo *)

BEGIN (* fspnew *)
   getfspinfo;(* input all pertinent new purchase contract info *)
   (* go through the file and make sure that the given contract*
      is not already in the file *)
 RESET(fsphashfile,'*5:fsphashfile');
 REPEAT
    done := true;
    i := -1;
    REPEAT
       i := i + 1;
       SEEK(fsphashfile,i);
       GET(fsphashfile)
    UNTIL (EOF(fsphashfile)) OR
          (fsphahsfile^.number = fspcontract.number);

    IF fsphashfile^.number = fspcontract.number
      THEN REPEAT (* error! same contract already in table *)
             prompt(error1,3,choice);
             CASE choice OF
             1 : BEGIN CLOSE(fsphashfile);EXIT(fspnew) END;
             2 : BEGIN CLOSE(fsphashfile);fspinquery END;
             3 : BEGIN
                 REPEAT
                   write(chr(12),at(x,3),'Contract number
                                    (<ctrl-c> to quit):');
                   readln(fspcontract.number);
                 UNTIL (fspcontract.number <> ' ') OR EOF;
                 done := false;
                 IF EOF THEN BEGIN
                             CLOSE(fsphashfile);
                             RESET(INPUT);
                             EXIT(fspnew)
```

```
                                END
                    END;
                END; (* case *)
            UNTIL choice = 3
    (* no error so put into the fspfile and fsphashfile *)
ELSE BEGIN
        (* place the new purchase contract info into the fspfile;
           place at the first open slot *)
        RESET(fspfile,'#5:fspfile');
        (* put the contract info into the first open slot *)
        loc := -1;
        REPEAT
          loc := loc + 1;
          SEEK(fspfile,loc);
          GET(fspfile);
        UNTIL (fspfile^.status = empty) OR (EOF(fspfile));
        IF EOF(fspfile)
          THEN BEGIN
                write(chr(12),at(x,3),'DOOMESDAY! No more space
                                    to add new contract');
                write(at(x,4),'Must use new diskette.
                                          Press <RETURN>');
                readln;CLOSE(fspfile);EXIT(fspnew)
                END;
        fspfile^:= fspcontract;
        SEEK(fspfile,loc);
        PUT(fspfile); CLOSE(fspfile);
        write(at(0,22),'loc = ',loc);

        (* find open slot in fsphashfile *)
        RESET(fsphashfile);
        i := -1;
        REPEAT
           i := i + 1;
           SEEK(fsphashfile,i);
           GET(fsphashfile)
        UNTIL fsphashfile^.status = empty;
        (* put in the information *)
        WITH fsphashfile^ DO
        BEGIN
           status := occupied;
           number := fspcontract.number;
           name := fspcontract.farmer.name;
           link := loc;
           commodity := fspcontract.commodity
```

```
            END;
            SEEK(fsphashfile,i);
            PUT(fsphashfile);CLOSE(fsphashfile)
            END
      UNTIL  done
   END;   (* fspnew *)
```

APPENDIX B

THE dBASE III PLUS PROGRAMS

```
*****           program HANAOKA
*****       Original written in Apple Pascal
*****       Rewritten in dBASE III PLUS
*****       Author : To Chang
*****       Date : June 1987
*****       Instructor : Prof. Thomas C. Wu

clear all
set talk off
set bell off
set dele on
set exact on

store .T. to badentry

do while badentry
    clear
    @ 10,10 say '          Password : (or hit <CR> to exit...)'
    @ 10,50

set escape off
set exact on
set console off
accept to mpass
set console on

if mpass = ' '
    set escape on
    set exact off
    clear
    return
endif

if mpass # 'HANAOKA'
    @ 20,20 say 'Incorrect password ... (hit <CR> to retry)'
    ? chr(7)
    wait ' '
    loop
endif
store .F. to badentry
```

```
enddo


          *****          MAIN  MENU          *****
clear
store ' ' to mchoice
@ 02,15 say '++++++++++++++++++++++++++++++++++++++++++++++++'
@ 03,15 say '+                                              +'
@ 04,15 say '+                ABC     COMPANY               +'
@ 05,15 asy '+                                              +'
@ 06,15 say '++++++++++++++++++++++++++++++++++++++++++++++++'
@ 08,15 say '                      1. Sales'
@ 10,15 say '                      2. Purchase'
@ 12,15 say '                      3. Quit'
@ 18,15 say '           Choose one function -->(1,2,3)';
                          get mchoice pict 'x'
read

store .T. to mcontinue

do while mcontinue
   do case
      case mchoice = '1'
           do sale
      case mchoice = '2'
           do purchase
      otherwise
           store .F. to mcontinue
           clear
    endcase
enddo
close databases
quit
*       <End of HANAOKA>
```

```
*Program SALE.PRG   -----   called from HANAOKA
do while .T.
clear
store ' ' to mchoice
@ 02,15 say '++++++++++++++++++++++++++++++++++++++++++++++++++'
@ 03,15 say '+                                                +'
@ 04,15 say '+                ABC   Sale Information          +'
@ 05,15 say '+                                                +'
@ 06,15 say '++++++++++++++++++++++++++++++++++++++++++++++++++'
@ 08,15 say '              1. New Sale Contract Entry'
@ 10,15 say '              2. New Sale Shipment Entry'
@ 12,15 say '              3. Sale Information Inquery'
@ 14,15 say '              4. Quit'
@ 18,15 say '            Choose one function -->(1,2,3,4)';
                           get mchoice pict 'x'
read
do case
    case mchoice = '1'
         do newsale
    case mchoice = '2'
         do s_shipinfo
    case mchoice = '3'
         do s-inquery
    otherwise
         clear
         return
endcase
enddo
*       <End of SALE>
```

```
* Program NEWSALE.PRG   -----   called from SALE.PRG
clear

public mtotalship, mnofshipmnt, msnumber
do while .T.
   store      space(12)      to  msnumber, mlcnumber
   store      space(50)      to  mcommodity, mcustaddr
   store      space(80)      to  mpricebase
   store      space(30)      to  missuebank, mdrawbank
   store      space(18)      to  mmitino
   store      space(25)      to  mcname
   store      space(13)      to  mcustphone
   store      space(8)       to  mcontrdate, mlcexpdate, mlcshipdate
   store      ' '            to  manswer
   store      0              to  mlcbal, mwgt, mbal, mlcamount
   store      0              to  munitprice, mtotalship, mbalofship
   store      0              to  mnofshipment
   store      .T.            to  nogood, notok

do while notok
  do while nogood
    set confirm on
    set format to contract
    read
    if msnumber = '            '
          set format to
          set confirm off
          store .F. to nogood
          return
    endif
    use b:s_contract index b:s_conindx
    find &msnumber
    if found()
        ? chr(7)
        @ 04,50 say 'Duplicate key !'
        @ 24,05 say 'Replace? Discard? Inquery?(R,D,I)';
                    get manswer pict 'x'
        read
        if upper(manswer) = 'R'
              store .F. to nogood
              @ 24,05 say '                                    '
        endif
        if upper(manswer) = 'I'
              use
              close index
```

```
                do s_inquery
                return
            endif
            if upper(manswer) = 'D'
                clear all
            endif
        else
            set format to
            store .F. to nogood
        endif
    enddo
    store ' ' to manswer
    ? chr(7)
    @ 24,05 say 'Input OK?(y/n)' get manswer pict 'x'
    read
    if upper(manswer) = 'Y'
      store .F. to notok
    endif
enddo

do tmship

use
close index

use b:s_contract index b:s_conindx

append blank

replace snumber          with msnumber
replace cname            with mcname
replace contrdate        with mcontrdate
replace commodity        with mcommodity
replace pricebase        with mpricebase
replace lcnumber         with mlcnumber
replace lcexpdate        with mlcexpdate
replace lcshipdate       with mlcshipdate
replace lcbal            with mlcbal
replace lcamount         with mlcamount
replace totalship        with mtotalship
replace balofship        with mbalofship
replace issuebank        with missuebank
replace drawbank         with mdrawbank
replace mitino           with mmitino
replace nofshipmnt       with mnofshipmnt
```

```
use
close index

select 3
use b:customer index b:custindx
find &mcname
if .NOT. found()
    append blank
    replace cname              with mcname
    replace address            with mcustaddr
    replace phoneno            with mcustphone
endif
close databases
clear all
enddo
*       < End of NEWSALE.PRG >
```

```
* Program S_INQUERY.PRG   -----   called from HANAOKA or
*                                   or NEWSALE or S_SHIPINFO

do while .T.
clear
clear all
public mcontrno
store 0 to lctr
store ' ' to mchoice
store '           ' to mcontrno
store '                      ' to mcompname

@ 02,15 say '++++++++++++++++++++++++++++++++++++++++++++++++'
@ 03,15 say '+                                              +'
@ 04,15 say '+            SALE INFORMATION INQUERY          +'
@ 05,15 say '+                                              +'
@ 06,15 say '++++++++++++++++++++++++++++++++++++++++++++++++'
@ 08,15 say '          1. List Customer'
@ 10,15 say '          2. List All Contracts of One Customer'
@ 12,15 say '          3. List One Contract Info.'
@ 14,15 say '          4. Quit'
@ 22,15 say '        Choose one function --->(1,2,3,4)';
                       get mchoice pict 'x'
read

do case
    case mchoice = '1'
         clear
         @ 00,10 say '        +++++++   Customer List    +++++++'
         use b:customer index b:custindx
         do while .not. eof()
            store lctr+1 to lctr
            if lctr >= 19
               store 0 to lctr
               wait 'More list on next page...' to memvar
               clear
            endif
            @ lctr,02 say 'Name: '
            @ lctr,08 say cname
            store lctr+1 to lctr
            @ lctr,02 say 'Address: '
            @ lctr,11 say address
            store lctr+1 to lctr
            @ lctr,02 say 'Phone number: '
            @ lctr,16 say phoneno
```

```
          store lctr+1 to lctr
          @ lctr,10 say '==================================='
          skip
        enddo
      wait
      use
      close index
case mchoice = '2'
      clear
      @ 02,1 say 'Company Name = ' get mcompname;
                  pict 'xxxxxxxxxxxx'
      read
      @ 04,15 say 'Contract with '
      @ 04,30 say mcompname
      use b:s_contract index b:s_conindx
      disp all cname,commodity for cname = mcompname off
      wait
      use
      close index
case mchoice = '3'
      clear
      @ 12,20 say 'Contract Number:' get mcontrno;
                   pict 'xxxxxxxxxxxx'
      read
      @ 12,37 say mcontrno
      select 2
      use b:s_contra index b:s_conindx

      find &mcontrno
      if found()
            use
            close index
            do salelist
            @ 23,25 say ''
            accept 'Need a printout?(y/n)' to manswer
            if upper(manswer) = 'Y'
                  @ 23,00 say 'Turn on the printer,'
                  wait
                  set device to print
                  do salelist
                  set device to screen
            endif
            store ' ' to manswer
      else
            @ 20,20 say 'No such contract in the file!!'
```

```
                ? chr(7)
                wait
            endif
            use
            close index
        case mchoice = '4'
            return
    endcase
enddo
*           <End of S_INQUERY>
```

```
* Program S_SHIPINFO  -----  called from SALE.PRG

clear
store ' ' to manswer

do while .T.
   store          space(15)          to minvoiceno
   store          space(25)          to mname, morigin, mdest
   store          space(8)           to metd, minvdate
   store          space(12)          to msnumber, mcnumber
   store          0                  to mtotalbales, mtotalnet
   store          0                  to mnofcontner, mbales, mnet

   set confirm on
   set format to sshipment
   read
   if minvoiceno = '           '
        set format to
        set confirm off
        use
        close index
        return
   endif
   @ 24,20 say 'Input OK?(y/n)' get manswer pict 'x'
   read
   if upper(manswer) = 'Y'
        use b:contner index b:contnrdx
        append blank
        replace cnumber              with msnumber;
                invoiceno            with minvoiceno

        do scompute

        replace bales                with mbales;
                net                  with mnet

        store mtotalbales + mbales   to mtotalbales
        store mtotalnet + mnet       to mtotalnet
        store mnofcontner + 1        to mnofcontner

        store .F. to mcontinue
        @ 24,15 say 'More container?(y/n)-->' get manswer pict 'x'
        read
        if upper(manswer) = 'Y'
             store .T. to mcontinue
```

```
        @ 24,15 say '                                                    '
    endif
    do while mcontinue
        set format to contfmt
        read
        if mcnumber = '          '
            set format to
            set confirm off
            use
            close index
            store .F. to mcontinue
        else
            @ 24,15 say 'Input OK?(y/n)-->' get manswer;
                        pict 'x'
            if upper(manswer) = 'Y'
               @ 24,15 say '                                             '
               appnd blank
               replace cnumber          with mcnumber;
                       invoiceno        with minvoiceno

               do scompute

               replace bales            with mbales;
                       net              with mnet

               store mtotalbales + mbales  to mtotalbales
               store mtotalnet + mnet      to mtotalnet
               store mnofcontner + 1       to mnofcontner

               @ 24,15 say 'More containers?(y/n)-->' get;
                           manswer pict 'x'
               read
               @ 24,15 say '                                             '
               if upper(manswer) = 'Y'
                    store .T. to mcontinue
               else
                    store .F. to mcontinue
               endif
            endif
        endif
enddo

use b:s_shipmt index b:sshipdx

append blank
```

```
        replace invoiceno              with minvoiceno;
                name                   with mname;
                origin                 with morigin;
                dest                   with mdest
        replace etd                    with metd;
                invoicedat             with minvdate
        replace totalbales             with mtotalbales;
                totalnet               with mtotalnet;
                nofcontner             with mnofcontner;
                snumber                with msnumbr
        use
        close index
    endif
enddo
*          <End of S_SHIPINFO>
* Program SALELIST.PRG   -----   called from S_INQUERY.PRG

clear
set relation to cname into customer

@ 01,10 say '===== Feed Stuff Sale Contract Information ====='
@ 02,02 say 'Sale Number:'
@ 02,19 say snumber
@ 03,02 say 'Contract Date:'
@ 03,19 say contrdate
@ 04,02 say 'Customer Name:'
@ 04,19 say cname
@ 05,02 say 'Customer Address:'
@ 05,19 say address
@ 06,02 say 'Commodity:'
@ 06,19 say commodity
@ 07,02 say 'Price Base:'
@ 07,19 say pricebase
@ 08,02 say 'Time of Shipment              :  Months   Quantity   '
@ 08,46 say '  Balance   Unitprice'

store 9 to minctr
set relation to snumber into tmofship

do while .not. eof(tmofship) .and. snumber = mcontrno
     @ minctr,32 say month
     @ minctr,39 say wgt
     @ minctr,47 say bal
     @ minctr,57 say unitprice
```

```
      store minctr + 1 to minctr
      skip
enddo

@ minctr+2,02 say 'Total Shipment:'
@ minctr+2,22 say totalship
@ minctr+3,02 say 'Balance of Shipment:'
@ minctr+3,22 say balofship
@ minctr+4,02 say 'L/C number:'
@ minctr+4,22 say lcnumber
@ minctr+5,02 say 'L/C expire date:'
@ minctr+5,22 say lcexpdate
@ minctr+6,02 say 'L/c shipment date:'
@ minctr+6,22 say lcshipdate
@ minctr+7,02 say 'L/C amount:'
@ minctr+7,22 say lcamount
@ minctr+8,02 say 'L/C balance:'
@ minctr+8,22 say lcbal
@ minctr+9,02 say 'Issue Bank:'
@ minctr+9,22 say issuebank
@ minctr+10,02 say 'Draw Bank:'
@ minctr+10,22 say drawbank
@ minctr+11,02 say 'Miti number:'
@ minctr+11,22 say mitino
@ minctr+12,02 say '# of shipment made:'
@ minctr+12,22 say nofshipment

return
*          <End of SALELIST.PRG>
```

```
* Program SCOMPUTE.PRG  -----  called from S_SHIPINFO.PRG

public mnet
public mrate

store  0        to mrate

select 2
use b:tmofship index b:tmshipdx
set relation to snumber into tmofship

do while .not. eof(tmofship) .and. snumber = msnumber
    if month = substr(invoicedate,4,5)
        @ 12,15 say 'Rate = '
        @ 12,20 say unitprice
        @ 20,10 say 'Compute the price with the above rate?(y/n)';
                    get manswer pict 'x'
        read
        if upper(manswer) = 'N'
            clear
            @ 12,15 say 'Rate = ' get mrate pict '9999999999999.99'
        else
            store unitprice to mrate
        endif

        store totalnet/2000.0 to mshiintons
        store bal-mshintons to bal

        set relation to snumber into s_contra

        store balofship-mshintons to balofship
        store lcbal-mshintons*mrate to lcbal
    endif
    skip
enddo
use
close index
return
*         <End of SCOMPUTE.PRG>
```

```
* Program SALEPRT.PRG  -------  called from S_INQUERY.PRG

clear
store space(25) to mcname
select 2
use b:s_contract index b:s_conindx
find &mcontrno
@ 00,10 say '===== Feed Stuff Sale Contract Information ====='
@ 02,02 say 'Sale Number:'
@ 02,19 say snumber
@ 03,02 say 'Contract Date:'
@ 03,19 say contrdate
@ 04,02 say 'Customer Name:'
@ 04,19 say cname
store cname to mcname
select 3
use b:customer index b:custindx
find &mcname
   @ 05,02 say 'Customer Address:'
   @ 05,19 say address
select 2
@ 06,02 say 'Commodity:'
@ 06,19 say commodity
@ 07,02 say 'Price Base:'
@ 07,19 say pricebase
@ 08,02 say 'Time of Shipment    :       Months      Quantity  '
@ 08,46 say '     Balance        Unitprice'

store 9 to minctr
select 4
use b:tmofship index b:tmshipdx
do while .not. eof()
   if snumber = mcontrno
      @ minctr,32 say month
      @ minctr,39 say wgt
      @ minctr,47 say bal
      @ minctr,57 say unitprice
      store minctr+1 to minctr
   endif
   skip
enddo
select 2
@ minctr+2,02 say 'Total shipment:'
@ minctr+2,22 say totalship
@ minctr+3,02 say 'Balance of ship:'
```

```
@ mlnctr+3,22 say balofship
@ mlnctr+4,02 say 'L/C number:'
@ mlnctr+4,22 say lcnumber
@ mlnctr+5,02 say 'L/C expire date:'
@ mlnctr+5,22 say lcexpdate
@ mlnctr+6,02 say 'L/C shipment date:'
@ mlnctr+6,22 say lcshipdate
@ mlnctr+7,02 say 'L/C amount:'
@ mlnctr+7,22 say lcamount
@ mlnctr+8,02 say 'L/C balance:'
@ mlnctr+8,22 say lcbal
@ mlnctr+9,02 say 'Issue Bank:'
@ mlnctr+9,22 say issuebank
@ mlnctr+10,02 say 'Draw Bank:'
@ mlnctr+10,22 say drawbank
@ mlnctr+11,02 say 'Miti number:'
@ mlnctr+11,22 say mitino
@ mlnctr+12,02 say '# of shipment made:'
@ mlnctr+12,22 say nofshipment
eject
return
*   < End of SALEPRT.PRG >
```

```
* Program SALELIST.PRG ------- called from S_INQUERY.PRG

clear
store space(25) to mcname
select 2
use b:s_contract index b:s_conindx
find &mcontrno
@ 01,10 say '===== Feed Stuff Sale Contract Information ====='
@ 02,02 say 'Sale Number:'
@ 02,19 say snumber
@ 03,02 say 'Contract Date:'
@ 03,19 say contrdate
@ 04,02 say 'Customer Name:'
@ 04,19 say cname
store cname to mcname
select 3
use b:customer index b:custindx
find &mcname
   @ 05,02 say 'Customer Address:'
   @ 05,19 say address
select 2
@ 06,02 say 'Commodity:'
@ 06,19 say commodity
@ 07,02 say 'Price Base:'
@ 07,19 say pricebase
@ 08,02 say 'Time of Shipment    :      Months      Quantity  '
@ 08,46 say '     Balance        Unitprice'

store 9 to minctr
select 4
use b:tmofship index b:tmshipdx
do while .not. eof()
   if snumber = mcontrno
      @ minctr,32 say month
      @ minctr,39 say wgt
      @ minctr,47 say bal
      @ minctr,57 say unitprice
      store minctr+1 to minctr
   endif
   skip
enddo
select 2
if minctr >= 12
      wait 'More informations on next page...' to memvar
```

```
        store 0 to minctr
        clear
endif
@ minctr+2,02 say 'Total shipment:'
@ minctr+2,22 say totalship
@ minctr+3,02 say 'Balance of ship:'
@ minctr+3,22 say balofship
@ minctr+4,02 say 'L/C number:'
@ minctr+4,22 say lcnumber
@ minctr+5,02 say 'L/C expire date:'
@ minctr+5,22 say lcexpdate
@ minctr+6,02 say 'L/C shipment date:'
@ minctr+6,22 say lcshipdate
@ minctr+7,02 say 'L/C amount:'
@ minctr+7,22 say lcamount
@ minctr+8,02 say 'L/C balance:'
@ minctr+8,22 say lcbal
@ minctr+9,02 say 'Issue Bank:'
@ minctr+9,22 say issuebank
@ minctr+10,02 say 'Draw Bank:'
@ minctr+10,22 say drawbank
@ minctr+11,02 say 'Miti number:'
@ minctr+11,22 say mitino
@ minctr+12,02 say '# of shipment made:'
@ minctr+12,22 say nofshipment
return
*   < End of SALEPRT.PRG >
```

```
* Program CONTRACT.FMT ----- called from NEWSALE.PRG
@ 01,05 say date()
@ 01,15 say 'NEW SALE CONTRACT DATA ENTRY SCREEN'
@ 02,15 say '====================================='
@ 04,05 say 'Sale Number:       ' get msnumber pict;
                                  'xxxxxxxxxxxx'
@ 05,05 say 'Customer Name:     ' get mcname pict;
                                  'xxxxxxxxxxxxxxxxxxxxxxxx'
@ 06,05 say 'Customer Address:  ' get mcustaddr pict;
     'xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx'
@ 07,05 say 'Customer Phone#:   ' get mphoneno pict;
                                  '(xxx)xxx-xxxx'
@ 08,05 say 'Contract Date:     ' get mcontrdate pict;
                                  'xx/xx/xx'
@ 09,05 say 'Commodity:         ' get mcommodity pict;
     'xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx'
@ 10,05 say 'Price Base:        ' get mpricebase pict;
'xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xx'
@ 12,05 say 'L/C Number:        ' get mlcnumber pict;
                                  'xxxxxxxxxxxx'
@ 13,05 say 'L/C Exp. Date:     ' get mlcexpdate pict;
                                  'xx/xx/xx'
@ 14,05 say 'L/C Ship Date:     ' get mlcshipdate pict;
                                  'xx/xx/xx'
@ 15,05 say 'L/C Bale:          ' get mlcbal pict;
                                  '9999999999999.99'
@ 16,05 say 'L/C Amount:        ' get mlcamount pict;
                                  '9999999999999.99'
@ 17,05 say 'Issue Bank:        ' get missuebank pict;
              'xxxxxxxxxxxxxxxxxxxxxxxxxxxxxx'
@ 18,05 say 'Draw Bank:         ' get mdrawbank pict;
              'xxxxxxxxxxxxxxxxxxxxxxxxxxxxxx'
@ 19,05 say 'Miti Number:       ' get mmitino pict;
              'xxxxxxxxxxxxxxxxxx'
@ 23,05 say '--Leave all fields blank, and RETURN to exit--'
*   < End of CONTRACT.FMT >
```

```
* Program SSHIPMENT.FMT ----- called from S_SHIPIN.PRG
@ 02,01 say date()
@ 02,15 say 'NEW SALE SHIPMENT DATA ENTRY SCREEN'
@ 03,15 say '====================================='
@ 06,05 say 'Sale Number:     ' get msnumber pict;
                          'xxxxxxxxxxxx'
@ 07,05 say 'Customer Name: ' get mname pict;
                          'xxxxxxxxxxxxxxxxxxxxxxxxx'
@ 08,05 say 'Origin:              ' get morigin pict;
                          'xxxxxxxxxxxxxxxxxxxxxxxxx'
@ 09,05 say 'Destination:         ' get mdest pict;
                          'xxxxxxxxxxxxxxxxxxxxxxxxx'
@ 10,05 say 'Estimate Date:       ' get metd pict 'xx/xx/xx'
@ 11,05 say 'Invoice Date:        ' get minvdate pict 'xx/xx/xx'
@ 12,05 say '============ Container Data Entry =============='
@ 13,05 say 'Invoice Number:    ' get minvoiceno pict;
                          'xxxxxxxxxxxxxx'
@ 14,05 say 'Container Number: ' get mcnumber pict;
                          'xxxxxxxxxxxx'
@ 15,05 say 'Bales:                ' get mbales pict;
                          '9999999999999.99'
@ 16,05 say 'Net:                  ' get mnet pict;
                          '9999999999999.99'
@ 23,05 say '--Leave all fields blank, and RETURN to exit--'
*  < End of SSHIPMENT.FMT >
```

```
* Program TOFSHIP.FMT ----- called from NEWSALE.PRG
@ 01,05 say date()
@ 01,15 say 'TIME OF SHIPMENT DATA ENTRY SCREEN'
@ 02,15 say '=================================='
@ 04,05 say 'Month:          ' get mmonth pict '99'
@ 05,05 say 'Weight:         ' get mwgt pict '9999999999999.99'
@ 06,05 say 'Bales:          ' get mbal pict '9999999999999.99'
@ 07,05 say 'Unit Price:     ' get munitprice pict '9999999999999.99'
@ 23,05 say '--Leave all fields blank, and RETURN to exit--'
*  < End of TOFSHIP.FMT >



* Program CONTFMT.FMT ----- called from S_SHIPIN.PRG
@ 02,01 say date()
@ 02,15 say '              MORE CONTAINER DATA ENTRY SCREEN'
@ 03,15 say '              ================================='
@ 06,05 say 'Container Number:  ' get mcnumber pict;
                        'xxxxxxxxxxx'
@ 07,05 say 'Invoice Number:     ' get minvoiceno pict;
                        'xxxxxxxxxxxxxx'
@ 08,05 say 'Bales:                ' get mbales pict;
                        '9999999999999.99'
@ 09,05 say 'Net:                  ' get mnet pict;
                        '9999999999999.99'
@ 23,05 say '--Leave all fields blank, and RETURN to exit--'
*   < End of CONTFMT.FMT >
```

```
* Program PURCHASE ----- called from HANAOKA
set talk off
set bell off
set dele on
set exact on

do while .T.
clear
store ' ' to mchoice
@ 02,15 say '=========================================='
@ 03,15 say '=                                        ='
@ 04,15 say '=       HANAOKA Purchase Information     ='
@ 05,15 say '=                                        ='
@ 06,15 say '=========================================='
@ 08,15 say '         1. New Purchase Contract Entry'
@ 10,15 say '         2. New Purchase Shipment Entry'
@ 12,15 say '         3. Purchase Information Inquery'
@ 14,15 say '         4. Quit'
@ 18,15 say '     Choose one function -->(1,2,3,4)' get mchoice;
                    pict 'x'
read
do case
    case mchoice = '1'
         do newpurch
    case mchoice = '2'
         do p_shipin
    case mchoice = '3'
         do p_inquer
    otherwise
         return
endcase
enddo
*  < End of PURCHASE >
```

```
* Program NEWPURCH.PRG ----- called from PURCHASE.PRG
public mtotalship,mnofshipmnt,mpnumber
do while .T.
    store       space(12)          to mpnumber
    store       space(25)          to mfname
    store       space(50)          to mcommodity,maddress
    store       space(13)          to mphoneno
    store       space(8)           to mcontrdate
    store       0                  to mtotalship
    store       0                  to mbalofship
    store       0                  to mnofshipmnt
    store       .T.                to nogood,notok
    store       ' '                to manswer

do while notok
do while nogood
    set confirm on
    set format to contra_p
    read
    if mpnumber = '                '
        set format to
        set confirm off
        use
        close index
        return
    endif
    use b:p_contract index b:p_conindx
    find &mpnumber
    if found()
        ? chr(7)
        @ 06,50 say 'Duplicate key!!'
        @ 24,10 say 'Replace? Discard? Inquery?(R,D,I)-->';
                    get manswer pict 'x'
        read
        if upper(manswer) = 'R'
            store .F. to nogood
            @ 24,10 say '
        endif
        if upper(manswer) = 'I'
            use
            close index
            do p_inquer
            return
        endif
```

```
    else
        store .F. to nogood
        set format to
    endif
enddo
store ' ' to manswer
@ 24,15 say 'Input OK?(Y/N)-->' get manswer pict 'x'
read
if upper(manswer) = 'Y'
      store .F. to notok
else
      store .T. to nogood
endif
enddo

do tmship
use
close index
use b:p_contract index b:p_conindx
    append blank
    replace pnumber                 with mpnumber
    replace fname                   with mfname
    replace contrdate               with mcontrdate
    replace commodity               with mcommodity
    replace totalship               with mtotalship
    replace balofship               with mbalofship
    replace nofshipment             with mnofshipmnt
use
close index

use b:farmer index b:farmerdx
find &mfname
if .NOT. found()
    append blank
    replace fname                   with mfname
    replace address                 with maddress
    replace phoneno                 with mphoneno
endif
use
close index
enddo
*  < End of NEWPURCH.PRG >
```

```
* Program P_SHIPIN.PRG ----- called from PURCHASE.PRG
clear
store .T. to nogood
public mshipno,mpnumber,mcost,mtotalbales,mtotalnet
public mtruckcost,mcompute,mnet,mcutpntwgt,mrateacut
public mratebcut,mcost,mbales
do while .T.
clear
store       space(12)          to mshipno,mpnumber
store       space(12)          to mwgtticket,mcontrno
store       space(8)           to mmthday
store       0                  to mbales,mnoftruck
store       0                  to mnet,mcost,mratebcut
store       0                  to mrateacut
store       0                  to mtotalbales,mshipintons
store       0                  to mtotalnet,mcutpntwgt
store       0                  to mpayment,mtruckcost
store       ' '                to mcompute,manswer

@ 12,30 say ''
accept '                    Contract number:' to mcontrno
if mcontrno = '             '
     return
endif
select 2
use b:p_contract index b:p_conindx
find &mcontrno
if found()
    clear
    set confirm on
    do while nogood
    set format to pshipin
    read
    if mpshipno = '             '
         set format to
         set confirm off
         return
    endif
    @ 23,15 say ''
    accept '                      Input OK?(Y/N)-->' to manswer
    if upper(manswer) = 'Y'
        store ' ' to manswer
        @ 24,15 say '
        store .F. to nogood
```

```
      do pcompute
      use b:truck index b:truckndx
      append blank
      replace pshipno                    with mpshipno
      replace pnumber                    with mcontrno
      replace mthday                     with mmthday
      store   space(8)                   to   mmthday
      replace wgtticketno                with mwgtticket
      store   space(12)                  to   mwgtticket
      replace bales                      with mbales
      store   mtotalbales+mbales         to   mtotalbales
      store   0                          to   mbales
      replace net                        with mnet
      store   mtotalnet+mnet             to   mtotalnet
      store   0                          to   mnet
      replace cost                       with mcost
      store   mtruckcost+mcost           to   mtruckcost
      store   0                          to   mcost
      use
      close index
      @ 23,15 say ''
      accept '                 More trucks?(Y/N)-->' to manswer
      if upper(manswer) = 'Y'
           do truckin
      endif
endif
enddo
use
close index

store mtotalnet/2000.0 to mshipintons
use b:tofship index b:tshipndx
do while .NOT. eof()
   if pnumber=mcontrno
      if month = substr(mthday,1,2)
           store bal-mshipintons to bal
           store mshipintons*unitprice to mpayment
      endif
   endif
   skip
enddo
use
close index
use b:p_contract index b:p_conindx
do while .NOT. eof()
```

```
      if pnumber = mcontrno
         store balofship-mshipintons to balofship
      endif
      skip
   enddo
   use
   close index
   use b:p_shipment index b:pshipndx
   append blank

   replace pshipno              with mpshipno
   replace pnumber              with mcontrno
   replace noftruck             with mnoftruck
   replace totalbales           with mtotalbales
   replace totalnet             with mtotalnet
   replace payment              with mpayment
   replace truckcost            with mtruckcost
   use
   close index
else
   clear
   ? chr(7)
   @ 12,25 say 'No such contract in the file !!'
   @ 24,15
   wait
endif
enddo
*   < End of P_SHIPIN.PRG >
```

```
* Program TRUCKIN.PRG ----- called from P_SHIPIN.PRG
use
close index
use b:truck index b:truckndx
store .T. to mmore
do while mmore
clear
store ' ' to manswer
set confirm on
set format to truckfmt
read
if mwgtticket = '            '
     set format to
     set confirm off
     use
     close index
     return
endif
@ 23,15 say ''
accept '                    Input OK?(Y/N)-->' to manswer

if upper(manswer) = 'Y'
    store ' ' to manswer
    append blank
    replace pshipno          with mpshipno
    replace pnumber          with mpnumber
    replace mthday           with mmthday
    replace wgtticketno      with mwgtticket
    repalce bales            with mbales
    replace net              with mnet

    do pcompute

    replace cost             with mcost
    store   mtotalbales+mbales to mtotalbales
    store   0                  to mbales
    store   mtotalnet+mnet     to mtotalnet
    store   0                  to mnet
    store   mnoftruck+1        to mnoftruck
    store   mtruckcost+mcost   to mtruckcost

    @ 24,15 say '
    @ 23,15 say ''
    accept '                   More trucks?(Y/N)-->' to manswer
```

```
    if upper(manswer) = 'N'
        store .F. to mmore
        @ 24,15 say '
    endif
    store ' ' to manswer
endif
enddo
use
close index
return
*  < End of TRUCKIN.PRG >
```

```
* Program P_INQUER.PRG ----- called from HANAOKA.PRG or
*                                    from NEWPURCH.PRG or
*                                    from P_SHIPIN.PRG

public mcontrno
do while .T.
clear store ' ' to mchoice,manswer
store '                        ' to mcommoname
store '          ' to mcontrno,mshipno
@ 02,15 say '=============================================='
@ 03,15 say '=                                            ='
@ 04,15 say '=          Purchase Information Inquery       ='
@ 05,15 say '=                                            ='
@ 06,15 say '=============================================='
@ 08,15 say '           1. List all commodities'
@ 10,15 say '           2. List all contract of one farmer'
@ 12,15 say '           3. List one purchase contract info.'
@ 14,15 say '           4. Quit'
@ 20,15 say '            Choose one function -->(1,2,3,4)' get;
                        mchoice pict 'x'
read
do case
    case mchoice = '1'
         clear
         @ 02,15 say '==== List of all commodities ===='
         use b:p_contract index b:p_conindx
         display all commodity off
         wait
         use
         close index
    case mchoice = '2'
         clear
         @ 02,15 say "Farmer's name:" get mcommoname pict;
                     'xxxxxxxxxxxxxxxxxxxxxxxx'
         read
         @ 03,15 say 'Contract with '
         @ 03,32 say mcommoname
         use b:p_contract index b:p_conindx
         display all pnumber,commodity for fname=mcommoname;
            off
         wait
         use
         close index
```

```
case mchoice = '3'
     clear
     @ 02,15 say 'Contract Number:' get mcontrno pict;
                    'xxxxxxxxxxxx'
     read
     if mcontrno = '            '
        return
     endif
     use b:p_contract index b:p_conindx
     find &mcontrno
     if found()
        use
        close index
        do purlist
        @ 24,15 say 'Need a printout?(Y/N)-->' get manswer;
                    pict 'x'
        read
        if upper(manswer) = 'Y'
           @ 24,15 say 'Turn on the printer,'
           wait
           set device to print
           do purlist
           set device to screen
        endif
        store ' ' to manswer
        use
        close index
        clear
        @ 12,15 say 'See all shipments in sequence?(Y/N)';
                    get manswer pict 'x'
        read
        if upper(manswer) = 'Y'
           do pshlist
           @ 24,15 say 'Need a printout?(Y/N)' get manswer;
                    pict 'x'
           read
           if upper(manswer) = 'Y'
                set device to print
                do pshlist
                set device to screen
           endif
        endif
        store ' ' to manswer
     else
        @ 15,20 say 'No such contract in the file!!'
```

```
            ? chr(7)
        endif
        use
        close index
    case mchoice = '4'
        return
    endcase
enddo
*  < End of P_INQUER.PRG >
```

```
* Program TMSHIP.PRG ----- called from NEWPURCH.PRG
clear
store   space(2)          to mmonth
store   0                 to mwgt,mbal,munitprice
store   ' '               to manswer
store   .T.               to mcontinue
use b:tofship index b:tshipndx

do while mcontinue
   set confirm on
   set format to tofship
   read
   if mmonth = '  '
      set format to
      use
      close index
      return
   else
      ? chr(7)
      @ 21,15 say ''
      accept 'Input OK?(Y/N)-->' to manswer
      if upper(manswer) = 'Y'
         append blank
         replace month                  with mmonth
         store   '  '                   to   mmonth
         replace pnumber                with mpnumber
         replace wgt                    with mwgt
         replace bal                    with mbal
         store   0                      to   mbal
         replace unitprice              with munitprice
         store   0                      to   munitprice
         store   ' '                    to   manswer
         store   mtotalship+mwgt        to   mtotalship
         store   0                      to   mwgt
         store   mnofshipmnt+1          to   mnofshipmnt
      endif
   endif
enddo
*   < End of TMSHIP.PRG >
```

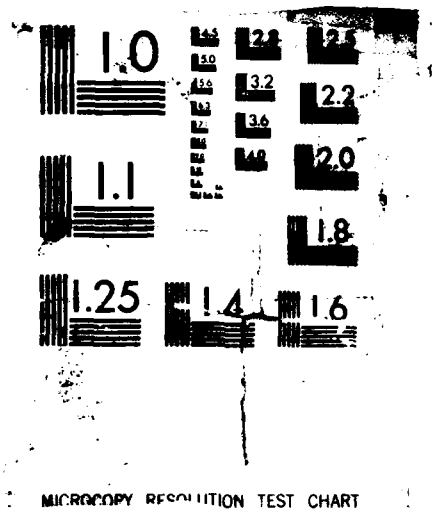
```
* program PURLIST.PRG ----- called from P_INQUER.PRG
clear
store space(25) to mfname
store ' '       to mlnctr
select 2
use b:p_contract index b:p_conindx
find &mcontrno
@ 01,02 say '=== Feed Stuff Purchase Contract Information ==='
@ 02,02 say 'Purchase number:'
@ 02,21 say pnumber
@ 03,02 say 'Contract date:'
@ 03,21 say contrdate
@ 04,02 say 'Farmer name:'
@ 04,21 say fname
store fname to mfname
select 3
use b:farmer index b:farmerdx
find &mfname
@ 05,02 say 'Address:'
@ 05,21 say address
select 2
@ 06,02 say 'Commodity:'
@ 06,21 say commodity
@ 07,02 say 'Time of shipment:  Month   Quantity   Balance
Unitprice'
store 8 to mlnctr
select 4
use b:tofship index b:tshipndx
do while .not. eof()
    if pnumber = mcontrno
       @ mlnctr,49 say unitprice
       @ mlnctr,35 say bal
       @ mlnctr,22 say wgt
       @ mlnctr,20 say month
       store mlnctr+1 to mlnctr
    endif
    skip
enddo
select 2
@ mlnctr+2,02 say 'Total Shipment:'
@ mlnctr+2,21 say totalship
@ mlnctr+3,02 say 'Balance of shipment:'
@ mlnctr+3,21 say balofship
@ mlnctr+4,02 say '* of shipments made:'
```

```
@ minctr+4,21 say nofshipment
eject
use
close index
return
*  < End of PURLIST.PRG >



* Program PSHLIST.PRG ----- called from P_INQUER.PRG
clear
store 0 to minctr
store space(12) to mshipno
select 2
use b:p_shipment index b:pshipndx
select 3
use b:truck index b:truckndx
select 2
store .T. to notdone
do while .not. eof() .and. notdone
   if pnumber = mcontrno
      @ 01,02 say 'Shipment No:'
      @ 01,21 say pshipno
      store .F. to notdone
   endif
   skip
enddo
store pshipno to mpshipno
@ 02,02 say 'Date     Wgt tkt#      Bales       Netwgt       Cost'
store 3 to minctr
select 3
do while .not. eof()
   if pnumber = mcontrno
     @ minctr,01 say mthday
     @ minctr,09 say wgtticketno
     @ minctr,21 say bales
     @ minctr,40 say net
     @ minctr,55 say cost
     store minctr+1 to minctr
   endif
   skip
enddo
```

```
select 2
@ minctr+1,02 say 'Total Bales:'
@ minctr+1,21 say totlabales
@ minctr+2,02 say 'Total Net:'
@ minctr+2,21 say totalnet
@ minctr+3,02 say 'Payment:'
@ minctr+3,21 say payment
@ minctr+4,02 say 'Truck Cost:'
@ minctr+4,21 say truckcost
eject
use
close index
return
* < End of PSHLIST.PRG >
```

AD-A184 027 COMPARISON OF PASCAL AND THE DBASE III PLUS LANGUAGE IN PROGRAMMING AN INVENTORY MANAGEMENT SYSTEM(U) NAVAL POSTGRADUATE SCHOOL MONTEREY CA T CHANG JUN 87 3/3

UNCLASSIFIED F/G 12/5 NL


1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.8
3.2
3.6
MICROCOPY RESOLUTION TEST CHART

```
* Program PCOMPUTE.PRG ----- called from P_SHIPIN.PRG
if upper(mcompute) = 'S'
    if (mnet/2000.0) < mcutpntwgt
        store (mnet/2000.0)*mratebcut to mcost
    else
        store (mnet/2000.0)*mrateacut to mcost
    endif
else
    if mbales < mcutpntwgt
        store mratebcut to mcost
    else
        store (mbales/mcutpntwgt)*mrateacut to mcost
    endif
endif
return
*  < End of PCOMPUTE.PRG >
```

```
* program CONTRA_P.FMT ----- called from NEWPURCH.PRG
@ 02,01 say date()
@ 02,15 say 'NEW PURCHASE CONTRACT DATA ENTRY SCREEN'
@ 03,15 say '========================================='
@ 06,05 say 'Purchase Number:' get mpnumber pict;
                  'xxxxxxxxxxx'
@ 07,05 say 'Farmer name:     ' get mfname pict;
                  'xxxxxxxxxxxxxxxxxxxxxxxx'
@ 08,05 say 'Farmer address:  ' get maddress pict;
   'xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx'
@ 09,05 say 'Farmer phone#:   ' get mphoneno pict;
                       '(xxx)xxx-xxxx'
@ 10,05 say 'Contract date:     ' get mcontrdate pict;
                        'xx/xx/xx'
@ 11,05 say 'Commodity:         ' get mcommodity pict;
   'xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx'
@ 12,05 say 'Total shipment:    ' get mtotalship pict;
                   '9999999999999.99'
@ 13,05 say 'Bales of shipment: ' get mbalofship pict;
                   '9999999999999.99'
@ 20,05 say '--Leave all fields blank, and <CR> to exit--'
*  < End of CONTRA_P.FMT >
```

```
* Program PSHIPIN.FMT ----- called from P_SHIPIN.PRG
@ 02,01 say date()
@ 02,15 say 'NEW PURCHASE SHIPMENT DATA ENTRY SCREEN'
@ 03,15 say '========================================'
@ 06,05 say 'Shipment Number:' get mshipno pict 'xxxxxxxxxxxx'
@ 07,05 say 'Cutting point Wgt: ' get mcutpntwgt pict;
                    '9999999999999.99'
@ 08,05 say 'Rate below cut point:' get mratebcut pict;
                    '9999999999999.99'
@ 09,05 say 'Rate above cut point:' get mrateacut pict;
                    '9999999999999.99'
@ 13,15 say '      NEW TRUCKS DATA ENTRY SCREEN'
@ 14,15 say '======================================='
@ 16,05 say 'Date:            ' get mmthday pict 'xx/xx/xx'
@ 17,05 say 'Wgt Ticket #:   ' get mwgtticket pict 'xxxxxxxxxxxx'
@ 18,05 say 'Bales:           ' get mbales pict '9999999999999.99'
@ 19,05 say 'Net:             ' get mnet pict '9999999999999.99'
@ 20,05 say 'Trucking rate computation by shorttons/bales(S/B)';
                              get mcompute pict 'x'
@ 23,05 say '--Leave all fields blank, and <CR> to exit--'
*   < End of PSHIPIN.FMT >
```

```
* Program TRUCKFMT.FMT ----- called from P_SHIPIN.PRG
@ 02,01 say date()
@ 02,15 say '       MORE TRUCKS DATA ENTRY SCREEN'
@ 03,15 say '========================================'
@ 05,05 say 'Date:              ' get mmthday pict 'xx/xx/xx'
@ 06,05 say 'Wgt Ticket #:     ' get mwgtticket pict 'xxxxxxxxxxxx'
@ 07,05 say 'Bales:             ' get mbales pict '9999999999999.99'
@ 08,05 say 'Net:               ' get mnet pict '9999999999999.99'
@ 23,05 say '--Leave all fields blank, and <CR> to exit--'
*   < End of TRUCKFMT.FMT >
```

```
* Program TOFSHIP.FMT ----- called from NEWPURCH.PRG
@ 01,05 say date()
@ 01,15 say 'TIME OF SHIPMENT DATA ENTRY SCREEN'
@ 02,15 say '====================================='
@ 04,05 say 'Month:         ' get mmonth pict '99'
@ 05,05 say 'Weight:        ' get mwgt pict '9999999999999.99'
@ 06,05 say 'Bales:         ' get mbal pict '9999999999999.99'
@ 07,05 say 'Unit Price:    ' get munitprice '9999999999999.99'
@ 23,05 say '--Leave all fields blank, and <CR> to exit--'
*  < End of TOFSHIP.FMT >
```

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